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Classification of Public Domain

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Bureau of Land Management
Missouri River Basin Studies
1967

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Land Planning and Classification Report of the public domain lands in the

TONGUE RIVER AREA

MONTANA and WYOMING

A Missouri River Basin Investigation

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DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

DENVER, COLORADO

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

November 1967

This report was compiled as a feature of the program of the Department of the Interior for the development of the resources of the Missouri River Basin.

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PRESENT STATUS OF BUREAU OF LAND MANAGEMENT STUDIES IN THE MISSOURI RIVER BASIN

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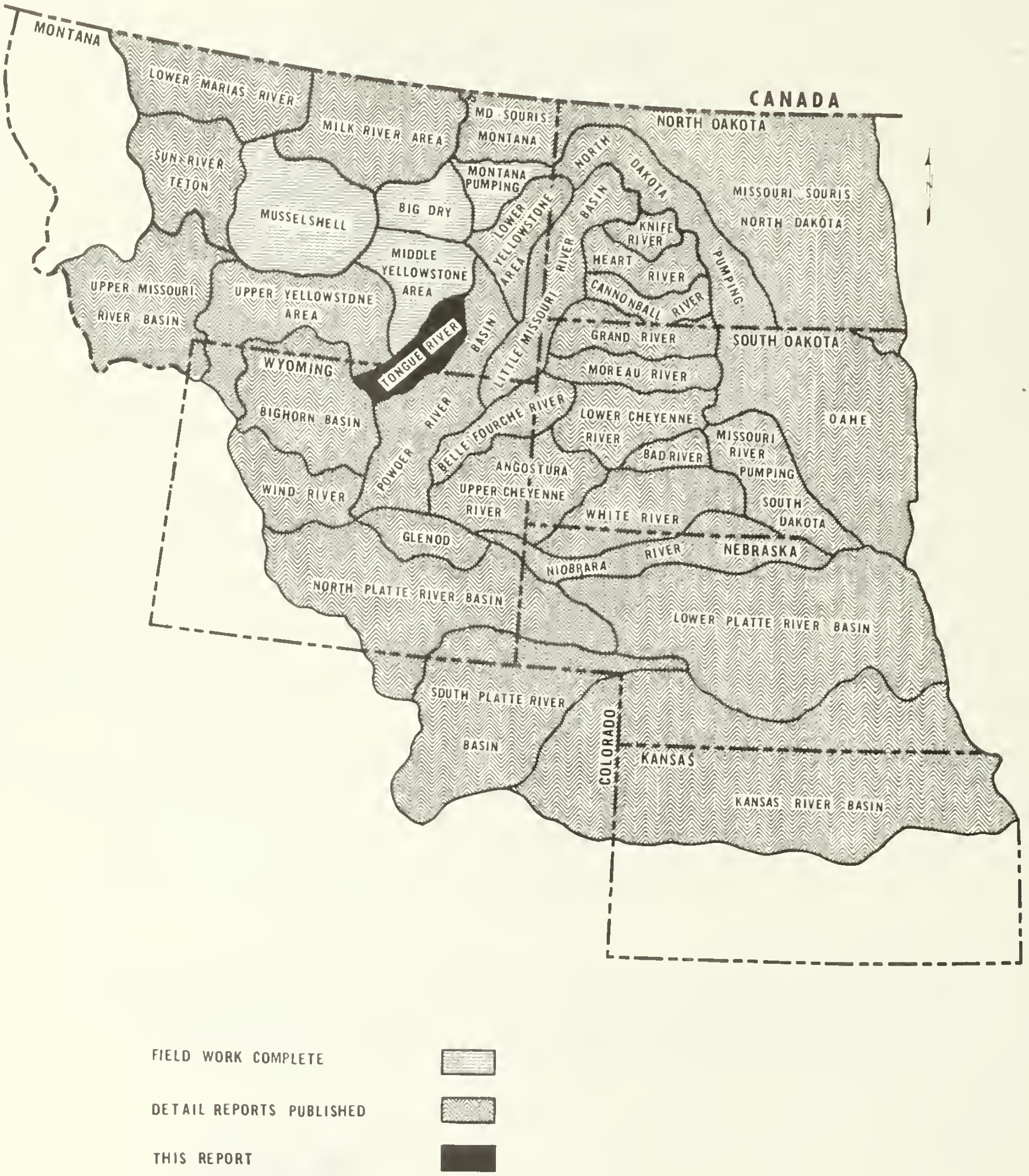

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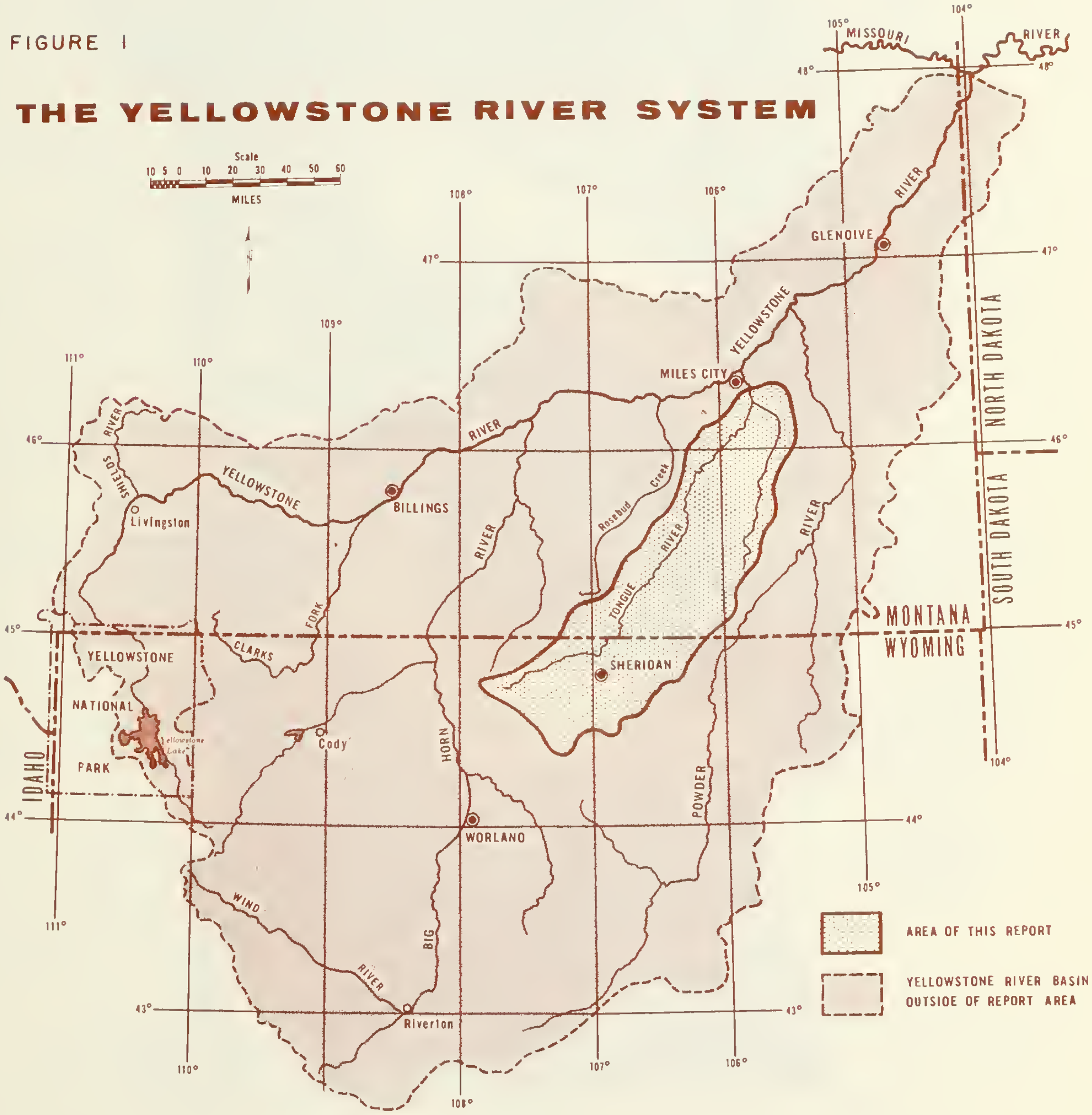
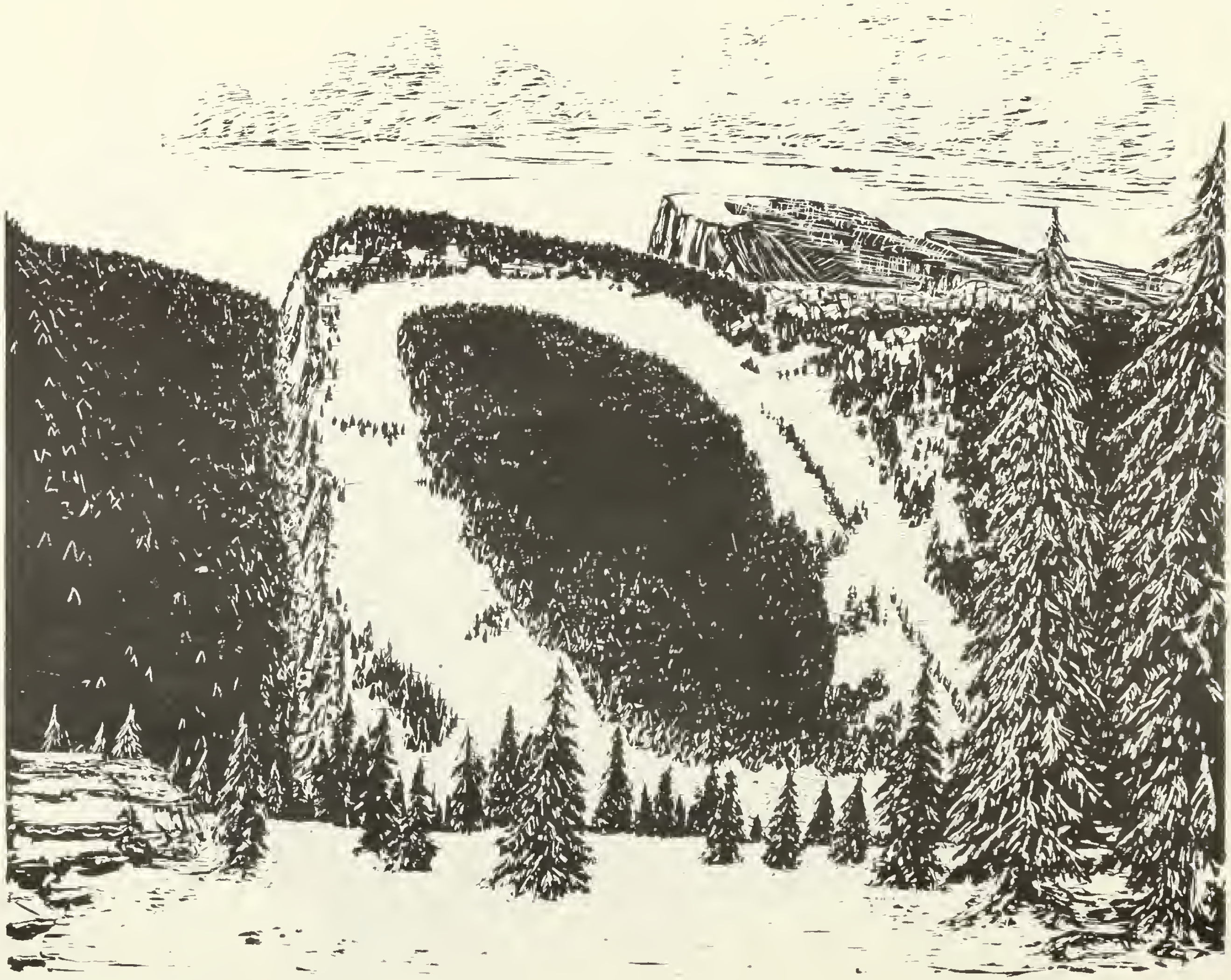
FIGURE I

THE YELLOWSTONE RIVER SYSTEM





THE TONGUE

Outlined by the barren white rock of an 1800 foot limestone slab, the "Tongue" gave its name to the stream that rises in the valley below. La-zee-ka was Crow Indian for the resemblance of the tree cover to the tongue of a buffalo.

FOREWORD

This report presents an analysis of the physical, economic and social factors of the Tongue River Drainage Basin of Montana and Wyoming, as they apply to the public lands administered by the Bureau of Land Management in trust for the people of the United States.

This publication is the 32nd in a series of 36 reports prepared by the Missouri Basin field group of the Bureau of Land Management in support of the Missouri River project. That project, which is a basin development program of the Department of the Interior, has its basic authority in the Flood Control Act of 1944 and is executed by the Secretary of the Interior through the Bureau of Reclamation. The Department, through the latter agency, finances Bureau of Land Management participation by transfer of funds.

This report presents summarized information of the background and detailed studies on which specific problems were considered and recommendations made for the management and tenure of the public domain lands. The purpose of the detailed study of each tract is to promote its use in the best interests of the public, compatible with proper conservation practices. Public agencies, both federal and local, interested in utilizing these lands are told of their location, description and prospective utility by two means, this report and the detailed accounts of each isolated tract.

For each isolated tract of land an inventory report was prepared, complete with maps, details of condition and recommendations for management. Those reports summarized in the following publication are filed in the Service Center of the Bureau of Land Management at the Denver Federal Center, with copies in the respective District Offices at Miles City, Montana and Casper, Wyoming.

The Tongue River derives its name from a peculiar timbered formation known, by the Indians, as the "Tongue". Located high in the Big Horn mountains it is not well known, even to local residents. A sketch of that "Tongue" is on the facing page.

A feature of this report which may prove of interest is the vertical relief panorama of the Tongue River drainage, following page viii. Constructed to scale, this diagram is presented as the best means possible within practicable limits of space, to illustrate topographic relationships within the study area.

The field inventory, analysis of data, and writing of this report were directed by Richard D. Burr, Supervisory Range Conservationist. The report preparation and layout were the responsibility of Mrs. Joan Robinson. The maps were prepared by draftsman John L. Kovacs. Editing and technical assistance were provided by Eugene L. Schmidt, MRB Program Specialist. Valuable assistance was rendered by the Bureau of Land Management District Offices at Miles City, Montana and Casper, Wyoming.

SUMMARY

The rectangular-shaped basin of the Tongue River is located in south-eastern Montana and north-central Wyoming, extending 150 airline miles from southwest to northeast and 50 miles in width. It is bounded on the east, south and west by tributaries of the Yellowstone River -- the Powder, the Bighorn and the Rosebud Rivers; the north boundary is an arbitrary cutoff about 16 miles from its mouth on the Yellowstone River at Miles City, Montana. (Map, fig. 1).

The basin contains 3,480,000 acres in six counties, 70 percent of the land being located in Montana and 30 percent in Wyoming. Of the total land area, 181,000 acres are administered by the Bureau of Land Management. Parts of the Big Horn and Custer National Forests, and the Northern Cheyenne Indian Reservation jointly account for 1,175,000 acres. Private, state and miscellaneous public lands comprise the remaining 2,124,000 acres.

The topography varies from rolling plains and eroded badlands in the northern part of the basin, to steep-walled canyons and mountain peaks in the Big Horn range to the south. Elevations vary from 2400 feet at the mouth of the Tongue to over 11,000 feet at the southwestern corner of the basin.

The Tongue has a river distance of 265 miles. Its principal tributary is Goose Creek which joins it below Sheridan, Wyoming to contribute almost one-half of the total flow. The average annual discharge of the Tongue at its mouth is 258,000 acre feet. Sufficient water is diverted for irrigation of 88,000 acres upstream from the gaging station.

Sheridan, with a population of 12,000,is the center of community services and economic activity in the upper basin; just outside the lower basin, Miles City, with 9,800 people, is another major trade center. Livestock ranches and irrigated farms are the economic backbone of the Tongue River economy, with tourism and coal mining also major contributors. Figure 2.

Lands administered by the Bureau of Land Management are distributed through the Tongue River drainage in a scattered pattern; the greatest frequency of tracts is in Custer County, Montana at the northern end of the basin.

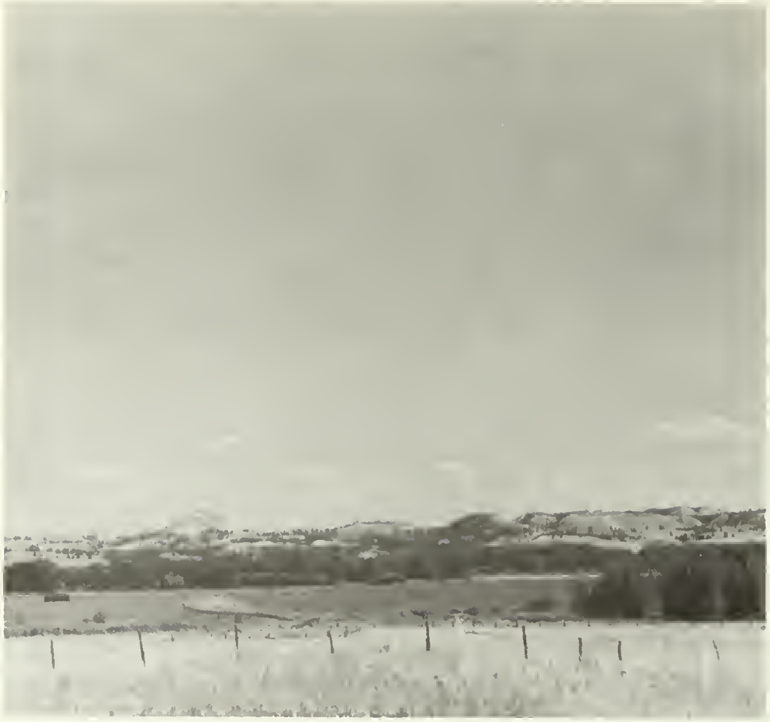


Figure 2 Irrigated haylands in mid-basin lie beneath brightly colored, forested cliffs and buttes of various shades of reds and yellows.

The public domain is used principally for livestock grazing. Vegetation is dominated by good quality perennial grasses. A comparison of present-day forage cover with that known to have been present over the past 160 years discloses moderate changes today. Ecologically this study disclosed 25 percent of the public lands to be in "Excellent" vegetative condition, 59 percent as being in "Good" condition, and 16 percent as "Fair"; less than 1 percent were in the "Poor" category.

Timber stands are concentrated in the Big Horn Mountains in the upper basin, and in the central highlands around Ashland, Montana. The vacant public lands are not important timber producers. Photographic comparisons show a significant increase in the number of conifers, especially pines, and a substantial invasion by them of new sites in the past 60 years.

Over the entire basin, 20 percent of the soils were found to have good potential as high producing grass land or cropland. Sixty percent of the soils have undeveloped or immature profiles which may limit productivity. The remaining 20 percent of the surface consists of mountains, badlands and rocky areas where the soil is shallow and of limited productivity. Figure 3.

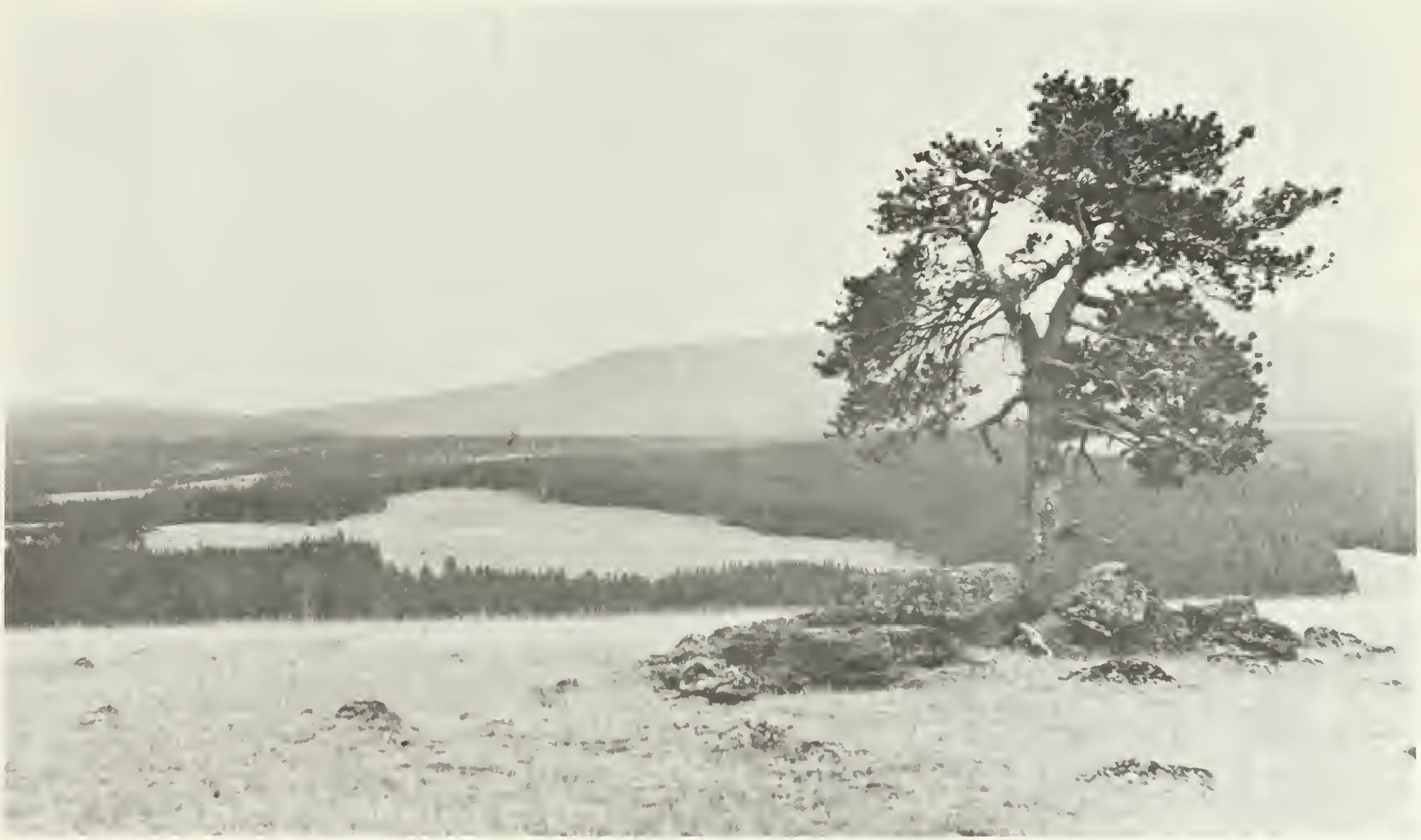


Figure 3 The higher elevations in the Big Horn Mountains have open parks intermingled with low-grade commercial stands of timber. Rock outcrops are common. Forage production is moderate. The broadly level aspect of much of the higher elevations is deceiving; steep, sheer-walled canyons dissect the mountains. This country lies on U. S. 14, a route to Yellowstone Park.

Seventy percent of the public domain in the Tongue River Basin falls in Land Capability Class VII which is well suited to grazing but must be carefully managed to overcome the hazards of adverse topography and shallow or unstable soils. Twenty-seven percent of the public domain is in Class VI which has relatively good soils and favorable topography, and requires only good grazing or timber management practices to sustain continued productive use. Class VIII lands comprise 2 percent of the public domain; this is principally valuable for watershed management and wildlife habitat. The remaining 1 percent is distributed between potentially arable land and other miscellaneous classes.

In measuring damage from accelerated water erosion, 53 percent of the public domain was found to be in the class of "none to slight", 42 percent was classed as "slight to moderate", and 5 percent was rated as "moderate to severe". Accelerated wind erosion was negligible on 93 percent of the public domain; on 7 percent of the land it was classed as "slight to moderate", and only .2 of 1 percent was in the "moderate to severe" wind erosion class. Photographic comparisons show a general stability or improvement in accelerated soil loss.

Classification of isolated tracts of land is found by tract in Appendix A. Out of 764 tracts, 296 totalling roughly 90,000 acres were recommended for retention for management by public agencies because of their potential for multiple use; 468 totalling 52,000 acres were deemed best suited for transfer to private ownership. An additional 3,500 acres best suited to private ownership have been transferred at this time.

The public lands are of growing importance from the standpoint of recreation, and fish and wildlife. They are a primary source of "open space" for expanding populations. The Tongue River drainage is within one of the nations surplus recreation areas, where opportunities exceed demand. Of the public lands considered suitable for retention, 90 tracts, containing 21,000 acres, possess special recreational values. There are 260 tracts, containing 43,000 acres, which have value for their fish and wildlife resources, or potential. In most cases, the recreation or fish and wildlife resources are found in combination with other significant values.

Roughly 40,000 acres of public domain lie in concentrations that cannot be inventoried as isolated tracts. These concentrations were inventoried by Area Classification, an overall examination that includes the intermingled lands of other ownerships. These lands were reported separately to the Miles City District Office. Statements on public domain of the Tongue River will include this Area Classification acreage if appropriate.

Recommendations made in this report concerning land tenure are not a final determination. An authorized administrative official of the Bureau of Land Management must pass on all land use proposals before any change in status occurs.

TABLE OF CONTENTS

Page

FOREWORD i
SUMMARY ii
TABLE OF CONTENTS v

THE TONGUE RIVER AREA
GENERAL DESCRIPTION
Location, Size and Natural Features 1
Climate 4
Geology 6
Mineral Resources 7
Soils 8
Vegetation 9

HISTORY
The Early Years 11
Historical Vegetation - Early Explorers 13
Wildlife - 1805 to 1860 15

ECONOMIC AND SOCIAL DEVELOPMENT
General 16
Agriculture and Forestry 17
Minerals 18
Transportation and Communication 19
Commerce and Trade 20
Community Services 21
Recreation 21
Present Economic Conditions and Outlook 21

THE PUBLIC LANDS
Characteristics and Administration 22
Historic Land Classification Reconnaissance (Circa 1924) .. 23
Range Vegetation 23
Range Condition 25
Range Condition of the Public Domain 26
Land Capabilities and Classes 27
Capabilities of the Public Lands 29
Soil Erosion 29

MISSOURI RIVER BASIN PHOTOGRAPHIC STUDIES 31

CLASSIFICATION AND MULTIPLE USE ACT 34

RECOMMENDATIONS ON THE PUBLIC DOMAIN 35

FIGURES

Number			Page
1	(Map)	Overall Location - Tongue River Area	
2	(Photo)	Irrigated Haylands in Mid-Basin	iii
3	(Photo)	Higher Elevations in the Big Horn Mountains (opposite)	iv
4	(Sketch)	Tongue River Basin, Vertical Relief	
5	(Map)	General Elevations Tongue River Area.(opposite)	2
6	(Photo)	Badlands (opposite)	3
7	(Photo)	Otter Creek Valley	3
8	(Map)	Growing Periods, Tongue River Area...(opposite)	6
9	(Map)	Annual Average Precipitation Tongue River Area back of figure 8	
10	(Map)	Geology of Tongue River Area opposite figure 9	
11	(Map)	Coal Resources of Tongue River Area..(opposite)	7
12	(Map)	Soils of Tongue River Area (opposite)	8
13	(Photo)	Wagon-Box Fight	12
14	(Photo)	Tongue-Powder Divide	14
15	(Photo)	Valley of the Lower Tongue River	17
16	(Map)	Major Forest Type, Tongue River Area (opposite)	19
17	(Photo)	Open Pit Mine	19
18	(Photo)	Medicine Wheel (opposite)	22
19	(Map)	Generalized Summary of Earliest Overall Land Classification (Circa 1924), Tongue River Area (opposite)	23
20	(Graph)	Range Types, Tongue River Area	23
21	(List)	Plant Frequencies (opposite)	24 & 25
22	(Graph)	Range Condition, Tongue River Area	26
23	(Photo)	Land Capability Class VI	27
24	(Photo)	Land Capability Class VII	28
25	(Photo)	Land Capability Class VIII	28
26	(Graph)	Land Capability Classes, Tongue River Area	29
27	(Photos)	Erosion, Tongue River Area... opposite figure 28	
28	(Photo)	Tongue River Valley (preceding)	30
29	(Graph)	Accelerated Soil Erosion from water Tongue River Area	30
30	(Graph)	Accelerated Soil Erosion from wind Tongue River Area	31
31	(Photos)	Comparison Pair opposite figure 32	
32	(Photos)	Comparison Pair (preceding)	32
33	(Graph)	Overall Trend,Tongue River Area	32
34	(Graph)	Timber Trend,Tongue River Area	32
35	(Graph)	Range Cover Trend, Tongue River Area	33
36	(Graph)	Trend of Accelerated Soil Erosion,Wind and Water. Tongue River Area	33 33
37	(Map)	Classification and Multiple Use Designation (opposite)	34

FIGURES (Cont.)

Number — Page

38 (Map) Indian Battles, Tongue River Area.......... B-2
39a (Graph) Trends in Range Condition and Cover, Missouri River Basin..................... B-14
39b (Graph) Trends in Range Condition and Cover, Tongue River Area........................ B-14
40a (Graph) Trends in Timber Cover, Missouri River Basin..................... B-15
40b (Graph) Trends in Timber Cover, Tongue River Area........................ B-15
41a (Graph) Trends in Accelerated Erosion, Missouri River Basin..................... B-16
41b (Graph) Trends in Accelerated Erosion, Tongue River Area........................ B-16
42a (Graph) Overall Trend, Missouri River Basin........ B-17
42b (Graph) Overall Trend, Tongue River Area........... B-17
43 through 57 Comparison Pairs of Photographs
58 (Sketch) Diagram of Piping.......................... B-22
59 (Photos) Erosion - Piping................(opposite) B-23
60 (Photo) Erosion - Gully.................(opposite) B-24
61 (Photo) Erosion - Sinks.................(opposite) B-24
62 (Photo) Annual Grass Cover......................... B-37
63 (Photo) Closeup of Annual Cover.................... B-38
64 (Photo) Annual Grass Cover......................... B-38
65 (Graph) Annual Precipitation, Miles City, Montana 1954-1960........................ B-39

TABLES

1 Precipitation Records Representative of the Plains Portion of the Tongue River Basin.. 5

APPENDICES

A Summaries of Isolated Tract Inventory...... A-1 thru A-30

B Section 1 History......................... B-1 thru B-3
Section 2 Vegetation, Wildlife, Erosion and Water - Early Journals.................. B-4 thru B-13
Section 3 Photographic Comparisons for Trend.............................. B-14 thru B-17

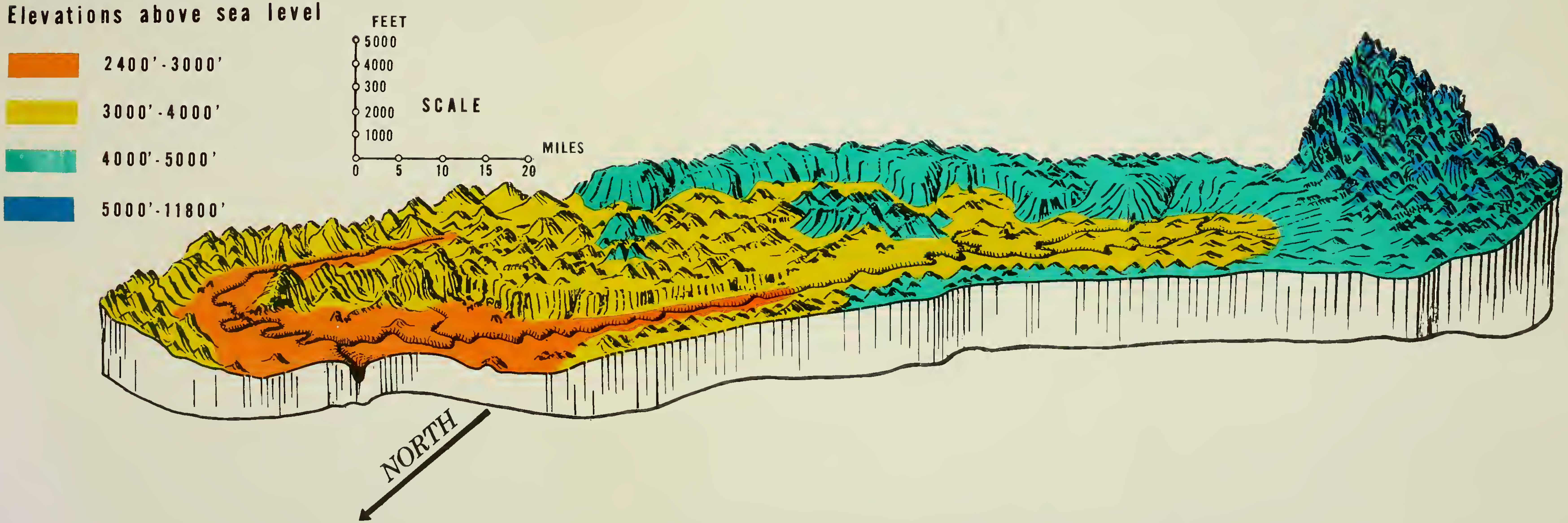
APPENDICES (Cont.)

Number		Page
B (Cont.)	Section 4 Soils..........................	B-18 thru B-21
	Section 5 Erosion - Piping.................	B-22 thru B-24
	Section 6 Economics and Social Development..	B-25 thru B-29
	Section 7 Land Classification Reconnaissance (Circa 1924)................	B-30 thru B-36
	Section 8 Annual Plants....................	B-37 thru B-39
C	Section 1 Range Vegetative Types............	C-1 thru C-5
	Section 2 Method of Rangeland Inventory.....	C-6 thru C-10
	Section 3 Guide to Plant Names as Used in U. S. Geological Survey 1924 Land Classification............................	C-11 thru C-13
	Section 4 Definitions of Land Classes Used by U. S. Geological Survey Land Classification (1924)......................	C-14 thru C-15

FIGURE 4

TONGUE RIVER AREA
VERTICAL RELIEF

(exaggeration 75:1)



THE TONGUE RIVER AREA

GENERAL DESCRIPTION

Location, Size and Natural Features

The Tongue River Basin is a rectangular, rolling to mountainous valley of southeastern Montana and northeastern Wyoming. Figure 4.

Formed by the Tongue River, an important tributary of the Yellowstone, it is a trough trending from southwest to northeast. The Powder River Divide is on the east, the Bighorn River and Rosebud Creek Divide's on the west and south, to the north the river basin cuts off 16 river miles above its mouth on the Yellowstone River, see figure 1.

From the Big Horn mountains, the Tongue River drainage extends northeast through Sheridan and Johnson Counties, Wyoming and Big Horn, Rosebud, Powder River and Custer Counties, Montana. The basin measures 50 by 150 miles in its extreme dimensions with an area of approximately 5,440 square miles. About 1,050,000 acres lie in Wyoming and 2,430,000 acres in Montana, a total of 3,480,000 acres.

The Bureau of Land Management administers 181,000 acres within the boundary of the drainage, 15,000 in Wyoming, and 166,000 in Montana. Those parts of the Big Horn and Custer National Forests that are included total approximately 730,000 acres. The Northern Cheyenne Indian Reservation contains 445,000 acres. The remaining land is privately and State owned.

The Tongue River flows 265 river miles from its source on the eastern slopes of the Big Horn mountains to Miles City, Montana, where it joins the Yellowstone River, a major tributary of the Missouri. Seventy-nine river miles are in Wyoming and 186 in Montana. The Tongue heads at over 11,000 feet above sea level dropping to 2,300 feet at its mouth at Miles City, Montana. Upstream, near the Montana-Wyoming State line the average annual flow is 304,000 acre feet, at its mouth the average annual discharge of the Tongue River is 258,000 acre feet.

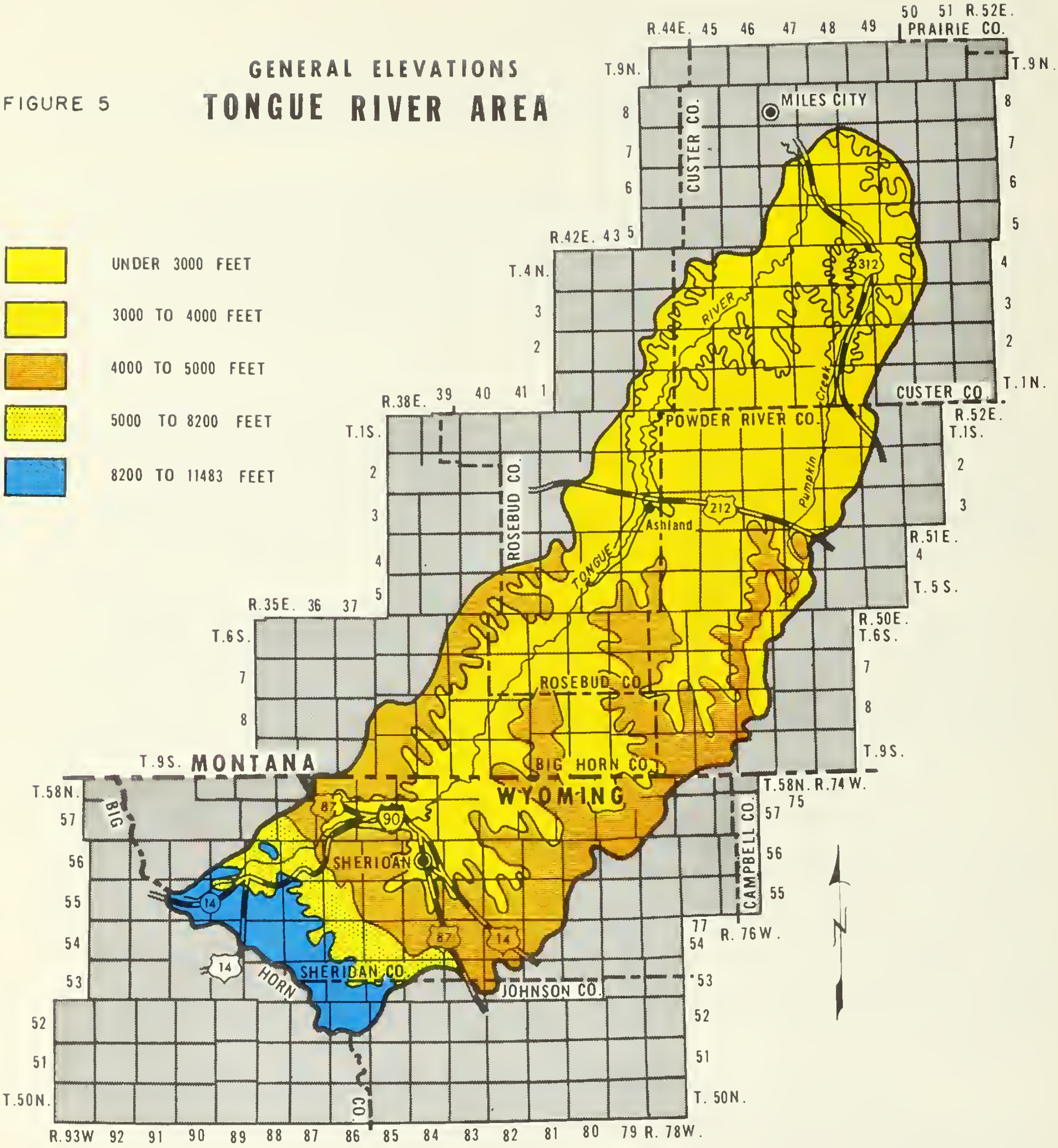
The basin bridges the transition from the Rocky Mountains to the Northern Great Plains. The highest point in the Tongue River Basin (11,809 feet above sea level) is on its divide with the Big Horn Basin. The steep slopes of the Big Horn mountains end abruptly on the plains which make up 90 percent of the basin. The lowest elevation lies on the plains at approximately 2,400 feet above sea level. Figure 5.

The Big Horn mountains are high, rocky and mostly forested. The largest acreage of arable land in the subbasin lies at their foot, in Wyoming. In Montana the basin is rough and rugged with

FIGURE 5

GENERAL ELEVATIONS

TONGUE RIVER AREA



most of the arable land limited to the narrow stream valleys, plateaus and some gently rolling upland. Relief grows less rugged toward the mouth of the river, but even there the steep slopes limit most land uses. The major streams and tributaries are usually paralleled by narrow flood plains which merge into rough, broken, eroded lands. Figure 6.

The rough terrain of mid-basin is covered with open stands of ponderosa pine. Most of the heaviest forested land lies within the Custer National Forest and the Northern Cheyenne Indian reservation.

The Big Horn mountains are the primary source of water for the Tongue; winter snowpack supplies most of the river's flow. Seventy-two percent of this water is used in irrigation in the upper basin on 88,000 acres. Downstream along the river valley 36,000 acres are irrigable but only 22,000 actually are irrigated, mostly near Miles City.

A decline in irrigation, especially on the lower stretches of the river, leaves excess irrigation water for projects in the Yellowstone River valley. Out of a total of 36,000 acres of irrigable land along the river,14,000 acres, nearly 40 percent, are not irrigated; 22,000 irrigated acres are usually in alfalfa for hay for local livestock. Ranchers can often buy hay cheaper than they can produce it; part of the decline in irrigation is attributable to this. Other reasons contribute, for example, in 1940 that small part of Custer County lying in the Tongue River Basin had 40 certified alfalfa seed growers, today there are none. The market is not there.

Irrigated pastures were popular,temporarily,on land that formerly produced alfalfa seed but water sales and quantities are now regulated and sold more strictly;the rising costs of irrigation has further reduced its use.

The uplands and valleys near the Montana-Wyoming State line grow satisfactory dryland crops of alfalfa hay; small grains, especially wheat, are produced in scattered patches. Farming occupies but a small part of the basin; most of its rough surface is devoted to grazing, figure 7.

Population, transportation and economic activity in the basin are greatest at the base of the Big Horn mountains in Wyoming, near Sheridan. Coal mining, irrigation farming , livestock ranching, industry and tourism have developed this section. Sheridan, with a population of 11,651, is surrounded by several smaller towns and communities. Miles City, Montana, 130 miles northward at the mouth of the Tongue River, has a population of 9,800. (This city and its surrounding farms are just outside the basin proper.) Ashland, in mid-basin -- the only town in the basin in Montana -- has a population of 150.

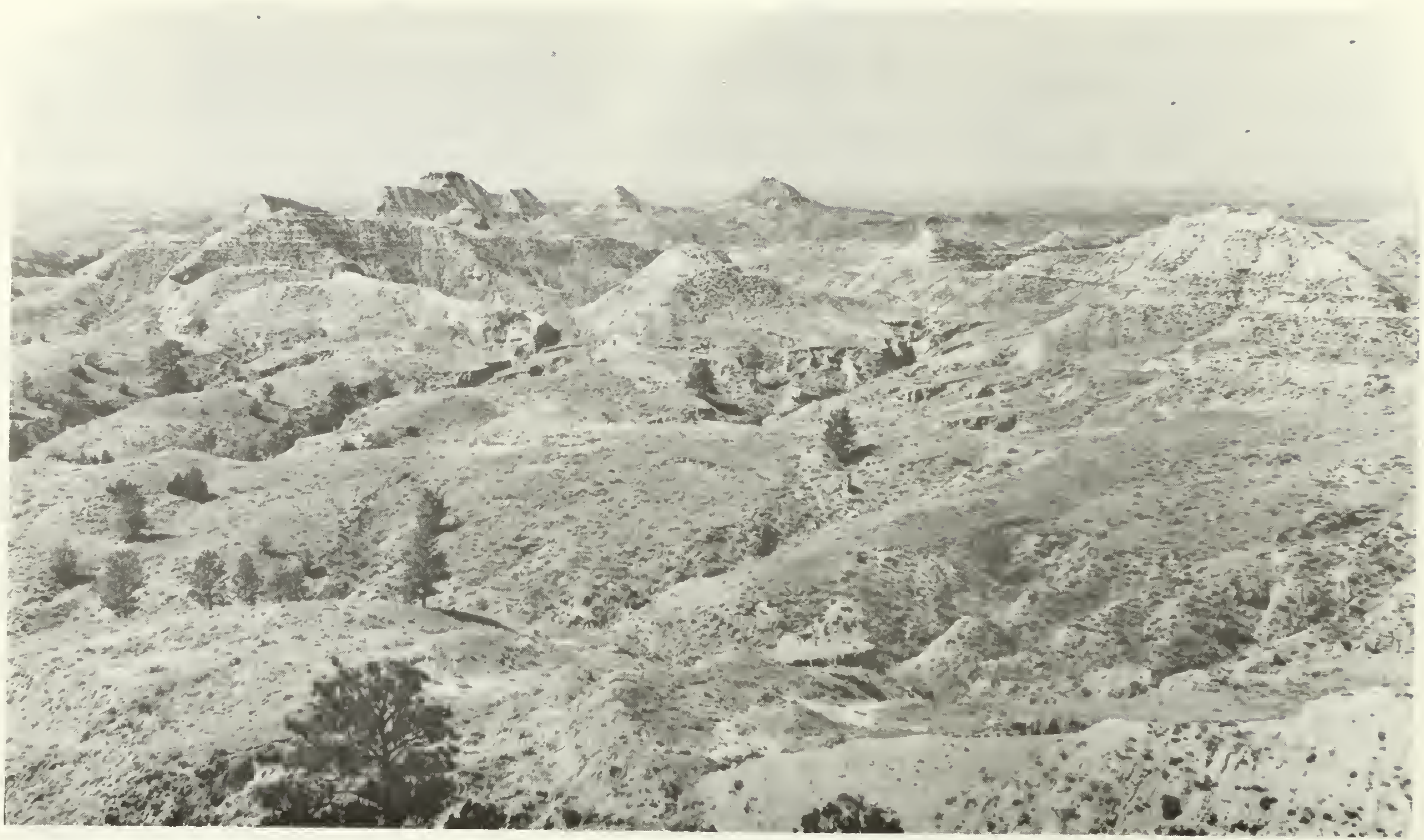


Figure 6 Badlands. Barren, scenic land (about two percent of the Tongue River Area). The highest point is Signal Butte, from which flashing mirrors relayed the news of the Custer disaster on the Little Bighorn River in 1876.

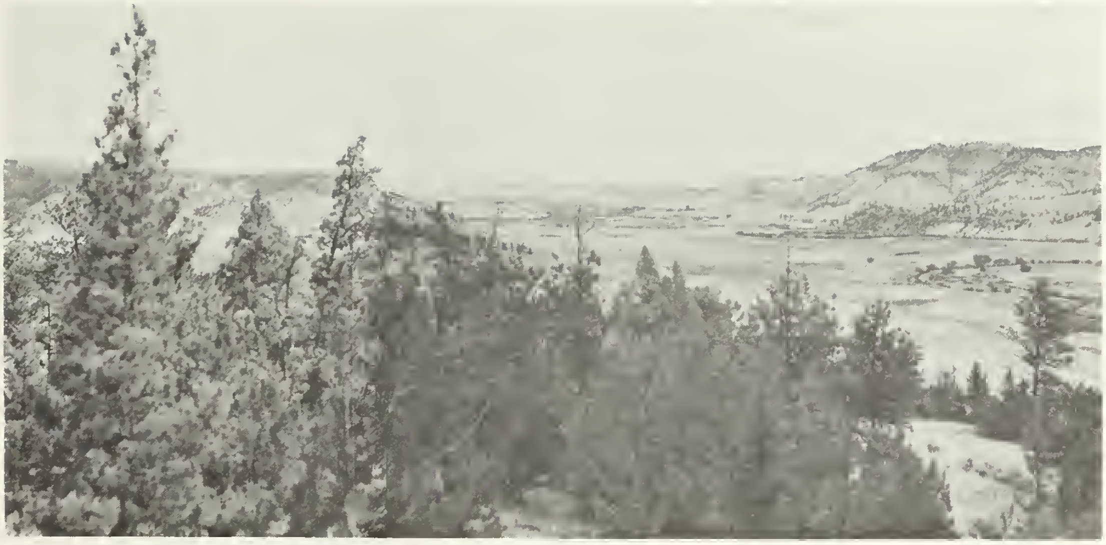


Figure 7 Otter Creek Valley, tributary to the middle reach of the Tongue River, viewed 10 miles southeast of Ashland, Montana. Valley bottoms of this kind, with their deep alluvial soils, irrigated alfalfa fields and native hay meadows, give stability to the livestock economy of the region.

Commercial transportation in the basin concentrates at two widely separated points near the headwaters in Wyoming and at the mouth of the river in Montana. In Wyoming the Burlington Railroad and U. S. Highways 14 and 87 - Interstate 90 - skirt the foot of the Big Horns. In Montana the Northern Pacific and Milwaukee Railroads and U. S. 10 and 12 - Interstate 94 - parallel the Yellowstone River through Miles City.

South of Miles City a gravel road goes up the river valley to Decker, Montana where it is paved to Sheridan, Wyoming. West from Sheridan, Wyoming U. S. 14 meets the Tongue River at Monarch, Wyoming and follows it close to the river's source in the Big Horn mountains. It then crosses the divide to the Big Horn Basin.

In Montana the basin is crossed by U. S. Highway 212, from east to west, and by U. S. Highway 312 from Miles City southward. Elsewhere numerous improved and unimproved roads interlace the basin. The U. S. Forest Service maintains roads open to the public in the Custer and Big Horn National Forests, plus a network of trails.

Regularly scheduled daily airline service is available from Sheridan, Wyoming and Miles City, Montana. These cities also have rail and bus lines and truck-line freight service. Public transportation in the basin from localities not on the railroad or on U. S. Highways 14 or 87 is limited to auto freight lines and mail carriers.

Climate

The Tongue River has two major climates. The mountain climate of 10 percent of the basin is one of deep snows, heavy precipitation, and long cold winters; growing seasons are short and freezing temperatures may occur in every month of the year. Precipitation, much of it as snow, varies from 20" to 40". Below timberline dense conifer forest is interspersed with open grassland parks on level benches.

Ninety percent of the basin lies below the mountains as a dissected plain ranging in elevation from 2400 feet to 5000 feet above sea level. Its semi-arid climate is a continental type with swift and violent changes of weather. Precipitation, from 10 to 15 inches, falls mostly in the growing season thereby increasing its effectivness for cropland, range plants and soil formation. (See table 1.)

Much of the summer precipitation occurs as thunderstorms often accompanied by high winds and hail. Hot dry periods with high winds are normal throughout the summer season. The summers are hot and winters are cold. Snows are heavy, high winds sweep the region especially in the wintertime and blizzards are common. Snowfall in the plains blows away most years, collecting as drifts in draws and low places leaving the fields and the roads bare. Snowfall at the higher elevations covers the ground with a lasting blanket.

Average growing seasons vary from about 135 days at Miles City, Montana to less than 50 days in the Big Horn mountains. The length of growing season varies considerably; unseasonable or early frosts are common. Figure 8.

Miles City, Montana with an average annual precipitation of 13 inches and Sheridan, Wyoming with 16 inches are typical of the basin. Figure 9.

The climate plus the effects of soils and terrain dictate the kind of native plants and limit choice of domestic crops as well as determining their production. Under irrigation, alfalfa, sugar beets or other hardy plants are the usual crops. Dry farming is usually confined to small grains, sorghums or corn under a fallowing system that produces a crop in alternate years. Farming, however, occupies but a small proportion, not over five to seven percent, of the basin acreage.

Most of the basin is in native grassland and timber used for livestock, wildlife, timber, recreation and watershed. Its broken terrain is valuable in this severe climate, for the badlands, the gullies and the arroyos, typical of 75 percent of the basin, give shelter in the winter to livestock and wildlife.

Table 1

Precipitation Records Representative of the Plains Portion of the Tongue River Basin 1/

Record Years	Station	Elevation above msl. feet	Annual Precipitation in inches			Growing Season Rainfall Apr-Sept	Annual Snowfall	Apr-Sept Snowfall
			Minimum	Normal	Maximum			
22	Ashland,Montana	2900	9	16	24	11	58	10
16	Broadus,Montana	3026	8	14	22	10	31	3
60	Busby,Montana	3500	6	12	18	9	44	8
33	Colstrip,Montana	3221	9	15	25	10	48	8
31	Garland,Montana	2600	6	13	23	9	35	4
15	Lame Deer,Montana	3331	9	17	26	12	51	7
27	Miles City,Montana	2629	7	13	19	10	28	2
33	Sheridan,Wyoming	3800	9	16	21	11	50	9

Average normal precipitation for the Plains, 14 inches.

Average growing season precipitation for the Plains, 11 inches.

All figures rounded to the nearest whole number and given in inches.

1/ Compiled from records of the Department of Commerce, Weather Bureau; Climatic Summaries of Montana and Wyoming, 1931-52; and Climatological Data, Annual Summary, Montana and Wyoming, 1953-63.

The cooler summers at higher elevations lure hundreds of visitors to summer vacations in the mountains; hunting brings more in the crisp dry air of autumn. The climate of the Tongue River shapes the basin's economy as agricultural production is most important and recreation follows close.

Geology

The Tongue River Area overlaps the boundary between two major physiographic provinces -- the Rocky Mountains and the Great Plains. Most of the area lies within the Great Plains province. The general topography of the plains is an upland plain entrenched by numerous streams. The Tongue River and its tributaries have wide flat valleys lying several hundred feet below the level of the upland plain. A transition zone of badland topography, resulting from erosion of soft shale beds, generally separates the more resistant upland plain from the river flood plains.

The southwestern end of the Tongue River Area lies within the Rocky Mountain Province on the eastern slope of the Big Horn mountains. The mountains rise abruptly, some of them as much as 7,000 feet above the general level of the plains.

The Big Horn range is a major northwestward-trending anticline, thrust upward during the Laramide orogeny some 75 million years ago. The core of the range is Precambrian granite, schist, and gneiss, partially covered by sedimentary formations ranging in age from Cambrian to Cretaceous. In the Tongue River Area, these formations dip steeply northeastward forming westward-facing hogbacks and escarpments. On the plains these earlier formations are overlain by younger Tertiary sediments.

The sedimentary rock of the Big Horn range is Cambrian and Ordovician cliff-forming sandstones, limestones and quartzites. Carboniferous rocks consist of the massive Madison limestone, the cliff-forming Tensleep sandstone, and some shales. Early Mesozoic rocks are represented by red shales and siltstones of the Chugwater formation and assorted sandstones, shales and gypsum beds of the Jurrasic age. Cretaceous rocks are predominantly shales with some sandstone and coal.

Almost all of the Montana portion of the Tongue River Area is underlain by the Fort Union formation of the early Tertiary (Eocene) age. This essentially flat-lying formation has a total thickness of about 2000 feet in the western part of the area where it is chiefly massive light yellow sandstone containing thick and extensive coal beds. Over large areas these coals have burned along the outcrops, forming thick beds of red and brown clinker or slag. The Fort Union formation was deposited some 50-60 million years ago in a vast shallow fresh-water lake which extended from east-central Wyoming to northern Montana

FIGURE 8

GROWING PERIODS
TONGUE RIVER AREA

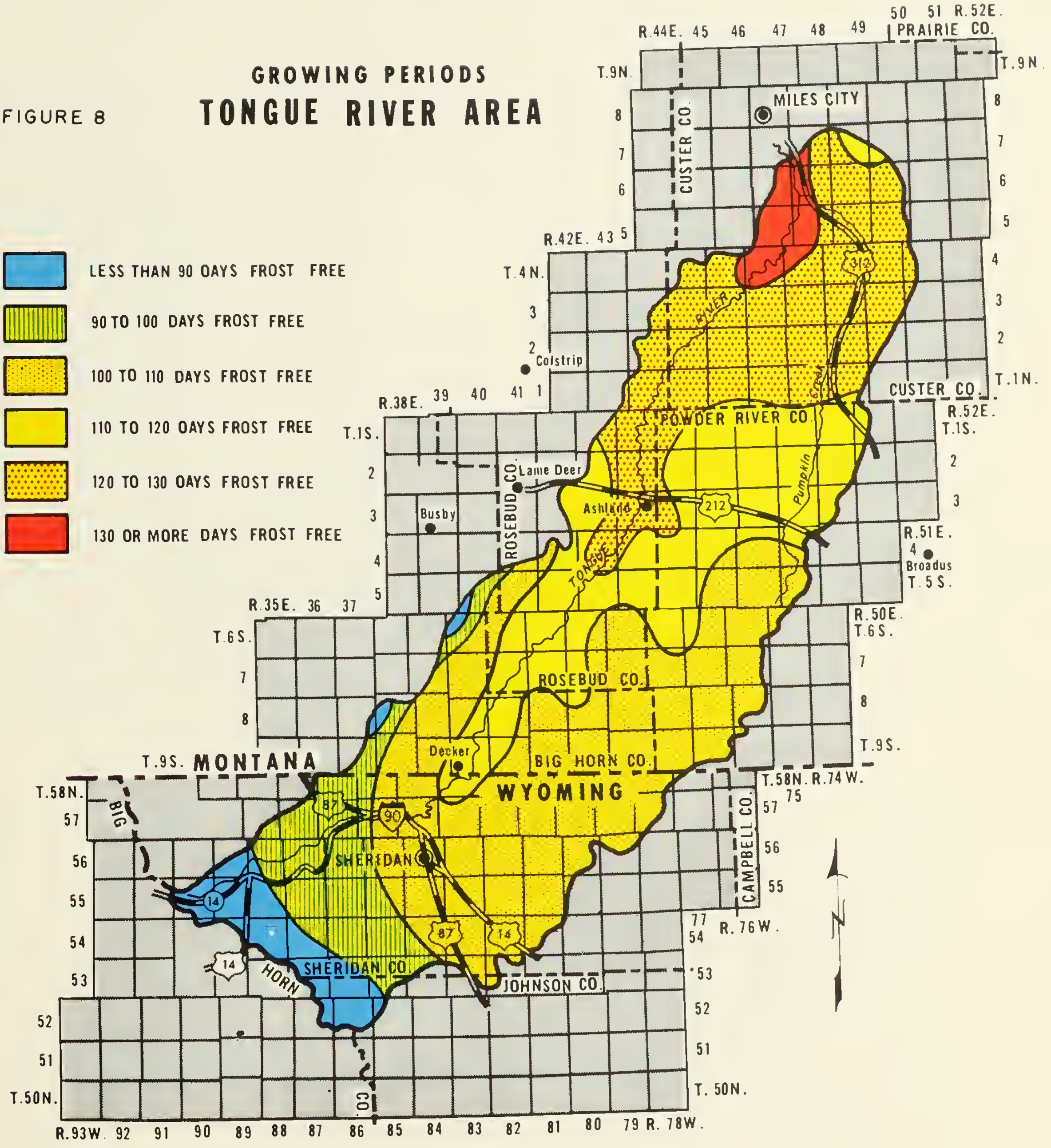


FIGURE 9

ANNUAL AVERAGE PRECIPITATION
TONGUE RIVER AREA

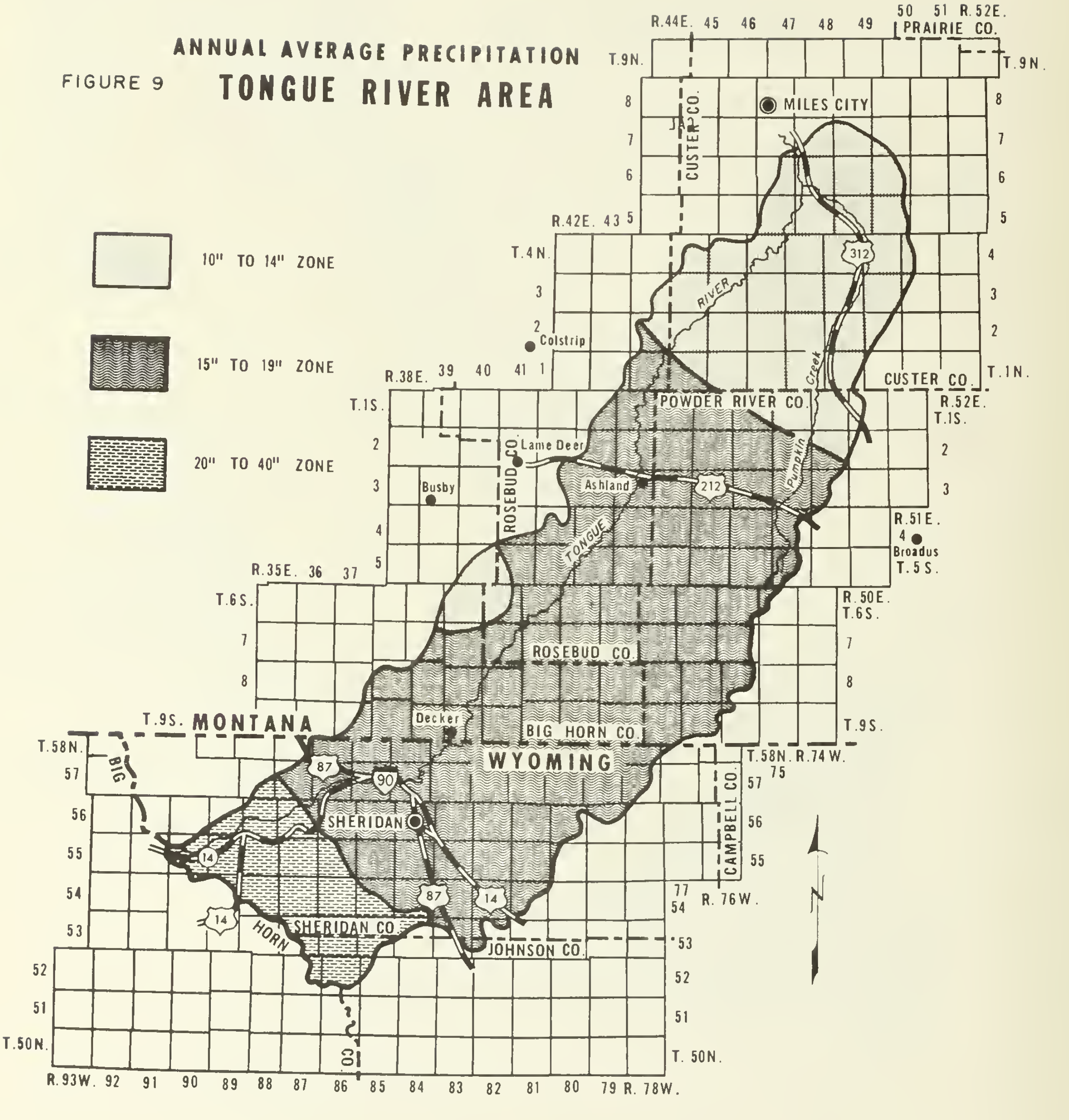


FIGURE 10

GEOLOGICAL MAP
TONGUE RIVER AREA

BASED ON GEOLOGICAL MAP OF MONTANA AND WYOMING
U.S. GEOLOGICAL SURVEY - 1955.

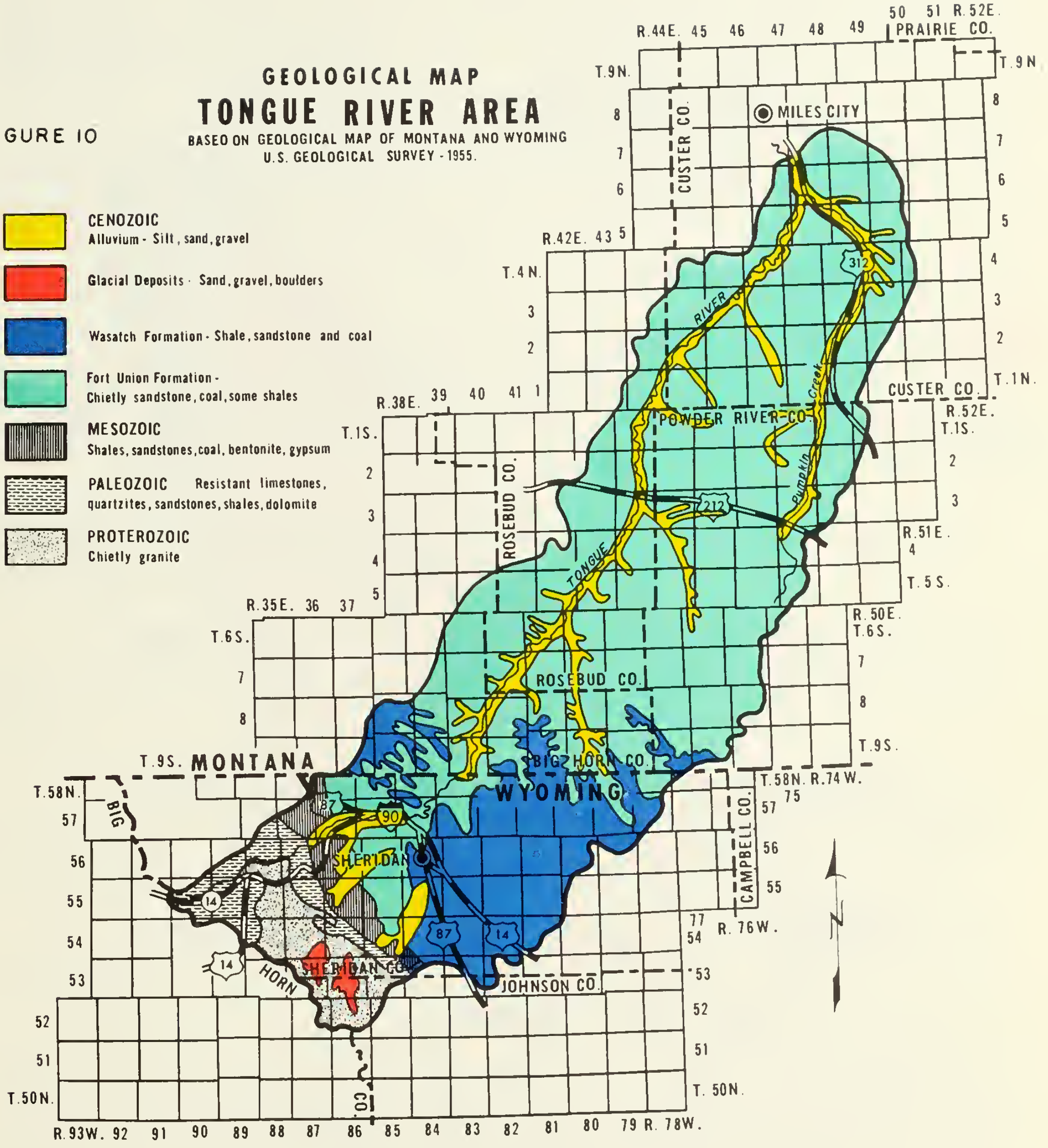
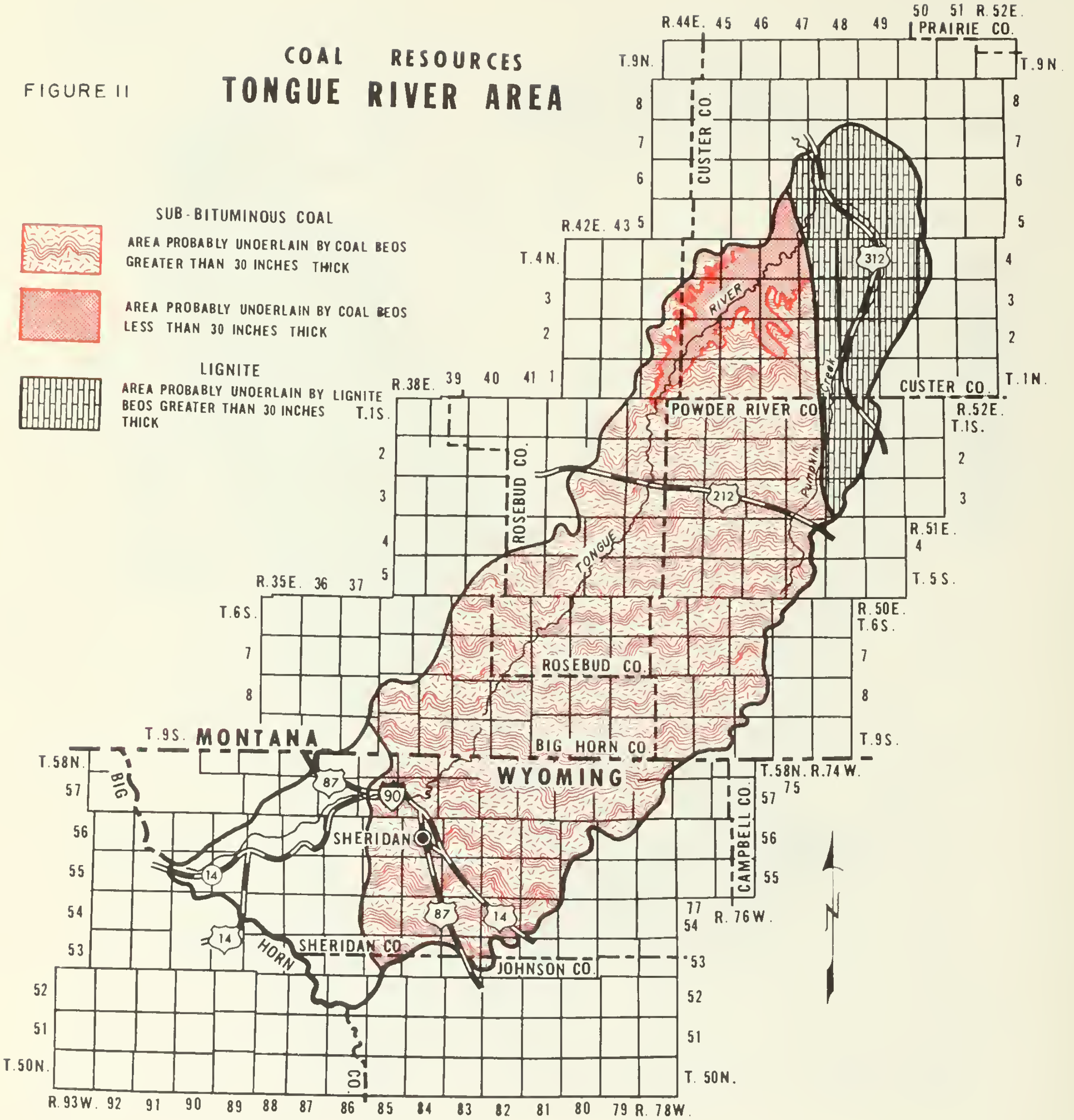

CENOZOIC
Alluvium - Silt, sand, gravel
Glacial Deposits - Sand, gravel, boulders
Wasatch Formation - Shale, sandstone and coal
Fort Union Formation - Chiefly sandstone, coal, some shales
MESOZOIC
Shales, sandstones, coal, bentonite, gypsum
PALEOZOIC Resistant limestones, quartzites, sandstones, shales, dolomite
PROTEROZOIC
Chiefly granite
MILES CITY
CUSTER CO.
PRAIRIE CO.
POWDER RIVER CO.
ROSEBUD CO.
BIG HORN CO.
MONTANA
WYOMING
SHERIDAN
SHERIDAN CO.
JOHNSON CO.
CAMPBELL CO.
TONGUE
RIVER
Pumpkin Creek
BIG HORN CO.
312
212
90
87
14
R.44E. 45 46 47 48 49 50 51 R.52E.
T.9N. 8 7 6 5 4 3 2 T.1N.
R.42E. 43
T.4N.
R.38E. 39 40 41
T.1S. 2 3 4 5
R.51E.
T.5S.
R.50E.
T.6S. 7 8 T.9S.
R.35E. 36 37
T.58N. R.74W. 75
57 56 55 54 53 52 51 T.50N.
R.76W.
77
R.93W. 92 91 90 89 88 87 86 85 84 83 82 81 80 79 R.78W.
N

FIGURE II

COAL RESOURCES
TONGUE RIVER AREA



SUB-BITUMINOUS COAL

▨ AREA PROBABLY UNDERLAIN BY COAL BEDS GREATER THAN 30 INCHES THICK

▨ AREA PROBABLY UNDERLAIN BY COAL BEDS LESS THAN 30 INCHES THICK

LIGNITE

▦ AREA PROBABLY UNDERLAIN BY LIGNITE BEDS GREATER THAN 30 INCHES THICK and from Livingston, Montana eastward to the center of North Dakota. Broad swamps and lowlands supporting luxuriant forests existed for long periods, forming thick and extensive coal beds. In this formation is a prolific flora of some 400 species of plants resembling those of modern times, and a fauna including fishes, fresh-water molluscs and reptiles.

Glacial deposits of sand, gravel and boulders occur locally in the higher areas of the Big Horn mountains. Recent unconsolidated deposits of sand, silt, clay and gravel are common as river floodplains, alluvial fans, and terraces.

Mineral Resources

Mineral resources include bentonite, coal, gypsum, natural slag, oil and gas, and limestone. Bentonite occurs in beds along the eastern flank of the Big Horn mountains. Just north of the Tongue River Area in Wyoming, several bentonite beds have been mined.

Gypsum crops out almost continuously along the Big Horn mountains through Sheridan County, Wyoming. Some of the gypsum has been mined and milled at Dayton, Wyoming.

Natural slag or scoria resulting from burned coal beds makes excellent road metal and railroad ballast. Slag occurring in the Tongue River Area is used extensively for this and as a local building material.

The geologic structure is generally unfavorable for the occurrence of major oil and gas deposits. Despite this a small oil field directly north of Sheridan, Wyoming has been developed on a small anticline known as the Ash Creek Dome.

Relatively pure limestone crops out in abundance along the east flank of the Big Horn mountains. Some of this has been quarried at Sheridan.

Large reserves of coal occur in the Fort Union formation, figure **11**. This coal varies from lignite in the extreme northeast to sub-bituminous coal over the greater part of the area; heat values of the coal range from 8000 to 9000 B.t.u. Many townships contain five to eight coal beds with average thicknesses of more than 6 feet; outcrops of coal beds to 10 feet thick are common. Beds 20 to 25 feet thick also occur over many square miles. These coal beds usually lie in a horizontal position near or at the surface; at least 1.4 billion tons of coal in Custer and Powder River Counties within the Tongue River Area are considered by the U. S. Geological Survey to be suited for strip mining.

Bureau of Land Management lands in the Tongue River Area, are leased for coal for thermo-electric power generation. A second use, production of petroleum-like products at the mine pit (the Cresap process - see Economics Appendix B) that can be piped to the refinery, is of recent interest.

The public lands hold much of the mineral wealth of the basin as coal. Industrial development will have a direct effect on all other users of public domain. Minerals lying under the surface, especially coal a leasable mineral, and bentonite a locatable mineral under mining laws, can both be strip mined. The surface is radically disturbed and dislocation of other users and interests is pronounced. Livestock, wildlife, recreation, and through soil erosion water quality and quantity would be affected not only now but for many years to come.

Rehabilitation of abandoned strip mines could be part of the lease terms. A locatable mineral, as bentonite is, will not be subject to any but State regulations. A management problem looms with further industrial development.

Soils (Figure 12, Soil Groups Map)

Soils of the mountains and alpine regions make up about 15 percent of the basin. The cold, humid climate of the highest elevations forms Alpine soils - shallow, gravelly to rocky soils, acid and high in organic matter. Sixty to ninety percent of the surrounding area may be rock outcrop or excessively shallow and stony.

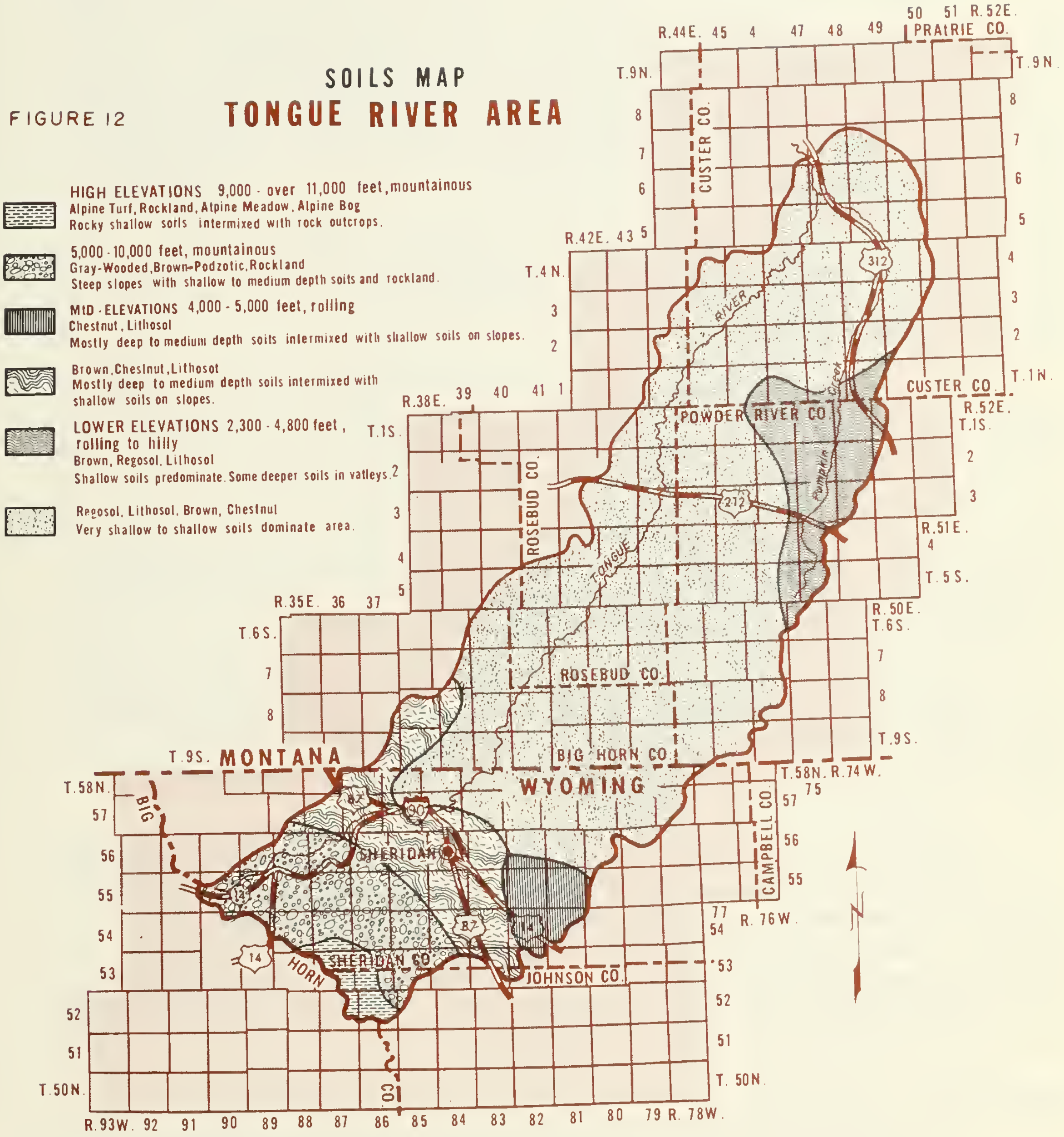
Under somewhat milder conditions in the lower elevations of the mountains, in sub-humid, cold climates and under conifer forests, Podzolic soils develop. These are acid soils of low fertility. Both Alpine and Podzolic soils have great importance for watershed production and recreation; timber and grazing is of considerably less economic value. Only a few tracts of public domain lie on Podzolic soils and none are found on the Alpine soils.

Below the Podzolic soil zone lie the most fertile soils of the basin, the Brown and Chestnut soils. Amounting to about 15 to 20 percent of the soils of the basin these Brown and Chestnut soils form at three to four thousand feet elevation, in a semi-arid climate. Deep and productive, normally in grass and sagebrush, they are now for the most part under irrigation or in dryland farming. (Note: A better developed profile on some of these soils has led to the speculation that they could not have developed in the present climate but represent a relict of the climate of the Pleistocene age.)

Most of the public domain lies on soils with undeveloped or immature profiles. These soils are strongly influenced by their parent materials, usually shales or sandstones.

FIGURE 12

SOILS MAP
TONGUE RIVER AREA



▤ HIGH ELEVATIONS 9,000 - over 11,000 feet, mountainous
Alpine Turf, Rockland, Alpine Meadow, Alpine Bog
Rocky shallow soils intermixed with rock outcrops.

▨ 5,000 - 10,000 feet, mountainous
Gray-Wooded, Brown-Podzolic, Rockland
Steep slopes with shallow to medium depth soils and rockland.

▥ MID - ELEVATIONS 4,000 - 5,000 feet, rolling
Chestnut, Lithosol
Mostly deep to medium depth soils intermixed with shallow soils on slopes.

▧ Brown, Chestnut, Lithosol
Mostly deep to medium depth soils intermixed with shallow soils on slopes.

▩ LOWER ELEVATIONS 2,300 - 4,800 feet, rolling to hilly
Brown, Regosol, Lithosol
Shallow soils predominate. Some deeper soils in valleys.

░ Regosol, Lithosol, Brown, Chestnut
Very shallow to shallow soils dominate area.

A limited amount of soils develop on alluvium in the valleys. These are level, deep soils, poorly developed but because of their location and their depth, and usually favorable water relationships, are highly productive.

Saline soils with a scattered stand of saline-tolerant plants make up a greater acreage of the public domain than the alluvial soils but are still uncommon. These soils are often structureless. They are susceptible to erosion because the soil plant cover is scant, and they lack granular soil structure because of the adverse action of sodium ions. Most important is that the clays of the saline soils are often montmorillonitic which in molecular structure is sandwich-like, swelling and shrinking with soil moisture. The pronounced cracks that form encourage specialized erosion, that of "piping" (Appendix B). Productivity on the saline soils varies with their location. Low-lying soils sometimes are quite productive with fair water relationships, others are almost barren.

By far the greatest acreage, 65 to 75 percent of the public domain, lies on Lithosols and Regosols. These are soils where soil removal nearly keeps pace with the weathering of the parent soft shales and sandstones. They are shallow to very shallow, occur on the steeper slopes and with relatively less plant cover. The terrain is usually dissected or lies as undulating or rolling plains often underlain by reddish scoria, slag from burning of prehistoric coal beds. These lands are principally valuable for recreation, livestock grazing, wildlife, and in the central part of the basin, timber.

Badlands, which are principally in the lower basin, make up only a small part of the Tongue River Area. These are steep, barren wastes; the weathered soil material is removed by wind and water erosion as it develops. These soils form principally on shales and clays. Geologic erosion is severe.

Basin soils, especially those lands of the federal government, are well adapted to their present uses, - livestock grazing, wildlife habitat and recreation. Their productivity varies but most (about 80 percent) are limited to producing permanent native vegetation. Much of the public domain possesses a marked aesthetic appeal because of the rugged country in which the soils lie. A more detailed account of soils of the basin is given in Appendix B.

Vegetation

A conclusion based on early narratives and photographic evidence is that plant cover of the Tongue River Basin has changed relatively little since the days of early exploration (beginning in 1805). See Appendix B.

The mountains are timbered by stands of lodgepole pine, Douglas-fir, Engelmann spruce, limber pine and ponderosa pine; old burns are covered with aspen. Cottonwoods are common in the valleys. Timber on the plains, mostly ponderosa pine, grows on the shallow-soiled rocky mesas and ridges.

Lodgepole pine, Douglas-fir and ponderosa pine are the principal lumber producers of the subbasin. Of these trees ponderosa pine is the most common on the public domain. Usually dwarfed and scattered it has local value for building and repairs on the ranches. Ponderosa pine occurred on 40 out of every 100 range sites on public domain.

Grasses, however, dominate the public domain. Bluestem (western) wheatgrass and blue grama are the most common grasses, followed in order by needleandthread and bearded bluebunch wheatgrass. Bearded bluebunch wheatgrass is in relatively large amounts (at least 15 percent) on nearly two-thirds of the range sites on public domain. Carexes, especially threadleaf sedge, are other important widely distributed plants. Inland saltgrass and alkali sacaton are usually found on the saline flats, rocky slopes have little bluestem, sideoats grama and often prairie sandreedgrass.

The most common shrub is big sagebrush on 85 out of 100 range sites. Broom snakeweed is found on nearly every other range site, as are silver sagebrush and fringed sagebrush. Skunkbrush is widely scattered. Chokecherry, curlleaf mountain mahogany, aspen, snowberry, greasewood, rose and willows are conspicuous but limited on public domain - localized by topography and soils they are concentrated in small dense stands. Junipers are a common browse of significant value to wildlife, especially deer; they occur on nearly one-third of the range sites.

Poisonous plants are not overly important. Death camas is encountered most frequently in the spring, at other times of the year it is inconspicuous. Lupine, larkspur and horsebrush are relatively rare. Arrowgrass, seldom encountered, is strongly poisonous; even the smallest patches are potentially dangerous to livestock. Chokecherry, which is common, causes prussic acid poisoning after frost or sudden severe drouth, but it is normally rated as a valued forage plant.

Pricklypear cactus is scattered over rangelands of the basin but never reached 15 percent of the vegetation on any range site. Early explorers consistently record it.

Annual grasses and weeds increase and decrease from year to year with the fluctuation in the weather. On some range sites following prolonged drouth annual vegetation may make up as much as

95 percent of the plant composition. The next year only ten percent may occur. (Appendix B.) Downy chess, Japanese brome and sixweeks fescue are the basin's most common annual grasses. For details on vegetation see discussion on public domain, especially figure 21.

HISTORY

The Early Years

Before the Crow Indians reached the Big Horn mountains the Medicine Wheel lay on the divide separating the Bighorn and Tongue Rivers. Seventy feet across, with 28 spokes, the wheel probably dates from the mid-1700's. It still is used in Indian ceremonies.

The first account of the Tongue River is that of Larocque in 1805. The Northwest Fur Company sent him into the Yellowstone Basin ahead of Lewis and Clark to make friends with the Indians and corner the fur trade. The following year, Clark described the mouth of the Tongue as he canoed down the Yellowstone River on his way to meet Lewis on the Missouri.

That same year John Colter left the Lewis and Clark Expedition to trap fur as a free agent. From his time to 1830 fur trapping and trading grew and thrived as the sole commerce of the region. The fur market, however, began to decline about 1830 and by 1845 trapping had almost ceased.

Larocque in 1805 and Raynolds in 1859 both thoughtthe large numbers of game in the Tongue River Area came from a surprising lack of hunting pressure. Few Indians ventured in for more than furtive raids by war parties.

Indian wars, from 1860 on, brought attention to the basin. Fort Phil Kearney, established in 1866, was the center of a series of Indian battles at the south end of the Tongue River Basin. The famous Wagon-Box Fight in 1867, figure 13; the Fetterman Massacre in 1866; the Battle of Tongue River in 1865; and the Battle of the Rosebud in 1876, were all expressions of the conflict along the vital north-south lines of communication along the base of the Big Horns.

Figure 13 Wagon-Box Fight, near Fort Phil Kearney, Wyoming on the Tongue-Powder Divide, August 2, 1867.

Cattle were introduced into both Montana and Wyoming in the early 1860's, but the cattle industry did not really develop until about 1880. Then, with the extermination of the buffalo herds in 1882, the government was forced to purchase beef from the local ranchers to feed the Indians held on the reservations. This local market, plus unusually favorable growing seasons led to a boom in the cattle industry. Most of the Great Plains, however, had a drouth period lasting from 1883 to 1886. This drouth was capped by a severe winter in 1886-87 which almost eliminated the range cattle industry. A change in livestock management to provide supplemental winter feed stabilized the cattle industry and by the early 1900's cattle ranching developed into one of the major parts of the economy.

Irrigated farming was the first kind of agriculture in Montana. It started in the west in 1873 then gradually spread east and has remained important in the basin's agriculture since the mid-1880's.

Freight was first shipped by riverboat up the Missouri to the Yellowstone River but steamboats gave way to the more expensive but far more dependable railroads. The Northern Pacific Railroad's westward move across the Great Plains, halted by financial panic from 1873 to 1878, reached the valley of the Yellowstone River in 1881, followed up its valley to enter Miles City in the same year. (The trains crossed the Missouri River from 1879 to 1882 by ferry in the summer and by tracks laid upon the ice in the winter !) The Chicago Burlington and Quincy coming from the south at Alliance, Nebraska crossed north westward across the plains to reach the Tongue River Basin at Sheridan in the 1890's.

Tourism, an important part of the economy, had a very early start. In 1843 Sir William Drummond Stewart, a Scotsman, led a group on a "party of pleasure to the Rocky Mountains". The trip included the Tongue River Basin.

Today the basin is still essentially agricultural, thinly populated and with its industry still relatively undeveloped but showing promise. The open country and rugged terrain attracts both tourists and hunters.

Historical Vegetation - Early Explorers

The vegetation of today as compared to that recorded by the early explorers has not changed radically. Indeed rates of soil loss, quantity and quality of water, and quantity and quality of forage, are probably not much different today as in 1805-1860.

The early travelers write of difficult travel over gullied and often barren hills, with scant feed for the horses and sometimes a lack of drinkable water. Where the ground was level travel through dense stands of sagebrush was still difficult. A good example is Raynolds' comments as he crossed from the Tongue to the Powder River. Figure 14.

These early comments can help in objectively assessing erosion, runoff, water quality and kinds and amounts of plant cover. All these items were mentioned in early journals. The labor in moving wagons across country often resulted in detailed descriptions of the terrain. See Appendix B.

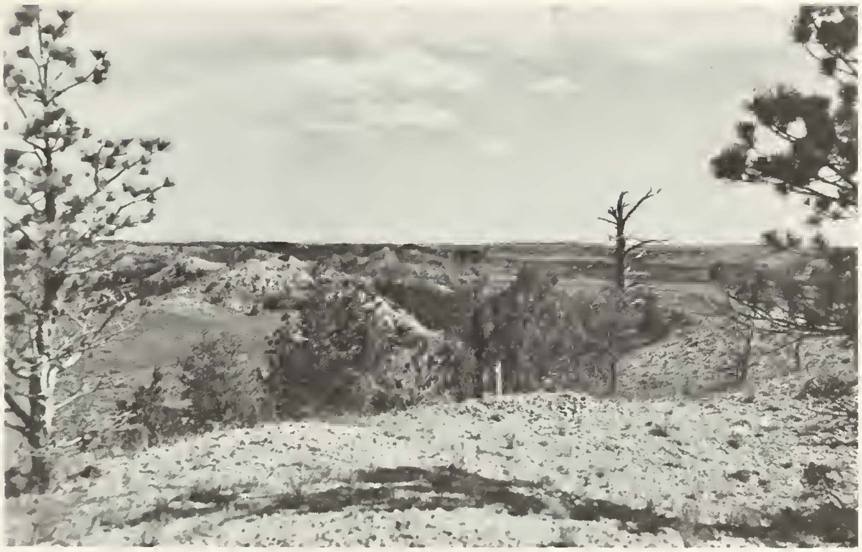


Figure 14 The Tongue-Powder Divide. August 3, 1859 Captain Raynolds started up the divide:"...The ascent was not specially steep, but a series of gullies crossed the path...encamped...about one and a half miles of the summit. Water was obtained by digging and sage and buffalo chips furnished fuel. The grass on the hills was scarce but excellent in quality.

"Thursday, August 4 -....The summit was reached in a march of about an hour....We were soon again among the"bad lands", whose acquaintance we had formed upon the Powder, and this amalgamation of sterile clay and stone, washed into gullies and totally devoid of vegetable life, surrounded us upon all sides....after a long march, we reached a deep gorge badly torn up by irregular ravines....we made a road over its rough surface and finally reached the plain, and headed for a belt of timber....Our progress was delayed by other gullies, so that we did not reach the stream and encamp until about 2 o'clock p.m.

"We found water in abundance standing in pools but of poor quality. The grass was scanty and miserable, and it was only after a long search, that we found pasturage of any description for our tired beasts. A further advance, however, was clearly impossible."

Wildlife - 1805 to 1860

Larocque in July 1805 wrote of the Powder River Basin adjoining the Tongue River:

> "...the plains on the western side of the river were covered with Buffaloes and the bottoms full of Elk and Jumping Deers and Bears which last are mostly yellow and very fierce..."

Clark, July 1806, had said of the Yellowstone Valley at a point not far distant from the Tongue:

> "...emence number of deer, elk and buffalow on the banks. Some beaver. For me to mention or give and estimate of the different species of wild animals on this river particularly Buffalow, Elk, Antilopes,and Wolves, would be incredible..."

Captain Raynolds, exploring the Upper Yellowstone Valley had already passed through the lower Tongue River Basin once and about to re-enter it, but higher in the valley, on September 12, 1859 noted:

> "...Bears are very numerous, more than a dozen having been seen in the course of the day's march, and one, a yearling cub, was brought down by Bridger's rifle. Elk, deer, and antelope have also been seen in abundance, and we can now understand why the Indians cling with such tenacity to their country. No buffalo have been seen to-day, but the number of skeletons visible upon all sides show that at times they are to be found here in large numbers..."

This observation backs up Larocques comment of 1805 on this section. (See Appendix B.)

Today the buffalo remain in tame herds and wolves are extinct.

The bear, elk and bighorn sheep have been forced from the plains into the high, rough mountain country. Antelope and deer, however, have increased. Big game hunting in the basin today is founded on these remnants of the great herds - antelope, deer and elk.

Sage and sharptailed grouse are the main upland game. They have increased in numbers through careful management. The Chinese pheasant and Hungarian partridge, after their introduction into the basin, are successfully naturalized.

Small animals such as the badger, fox, rabbit and prairie-dog are few. Racoons are on the increase. Beaver, even in the mountains, are rare.

Management of the public domain has a direct effect on the animal population especially for cover and forage. Too, the public domain affords hunting areas. The habitat seems but little changed as compared to the drastic reduction in wildlife - but the early accounts of the game of this country are of interest. (Appendix B.)

ECONOMIC AND SOCIAL DEVELOPMENT

General

Agriculture is the basic economic force of the basin. It is the largest employer and yields approximately 35 percent of the gross sales. Figure 15.

Sales and selected service enterprises rank second in total income.

Minerals, tourism, forest products and manufacturing, although important, are lesser contributors to the basin's economy.

The 1962 average family median income for the basin counties was approximately $4,900. The Tongue River Area runs slightly below the average income for the State.

Employment in government, finance and insurance are the leading sources responsible for recent gains in percentage of total income per capita.

Population, Development and Trends

Population in the Tongue River Basin from the time of early settlement increased fairly rapidly until 1920, from that point it has remained almost static. Since 1930, Rosebud and Powder River Counties have lost population, and Big Horn, Custer and Sheridan Counties have gained moderately.

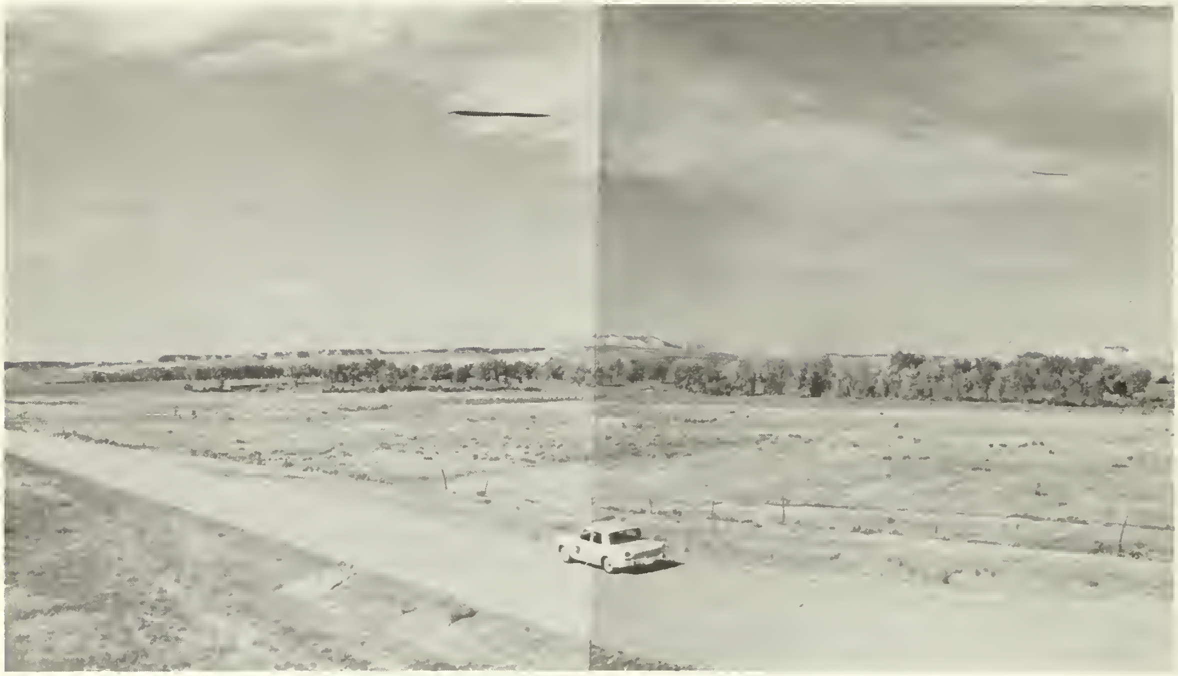


Figure 15 The broad, main valley of the lower Tongue River, 30 miles south of Miles City, Montana. Alluvial valley soils such as these are a primary agricultural resource. In the distance are badlands.

In 1960 about 23,000 persons lived in the Tongue River Basin. Sheridan, Wyoming with 11,600 was the largest town. All of the basin's urban communities have grown moderately, whereas rural communities have dropped in population. This reflects a nation-wide shift to urban living.

Agriculture and Forestry

Agriculture within the basin includes ranches raising livestock on native range, dryland farms, and intensive irrigated farming. Amounts of cropland in dryland or irrigation vary yearly depending on the vagaries of the weather and demand for crops. In the Tongue River Area 124,000 acres are irrigable with existing systems and between 90,000 and 110,000 acres are regularly irrigated. Approximately twice this acreage, around 180,000 to 200,000 acres, will be dry farmed.

Hay is the leading crop. In 1960 its value was almost two million dollars (250,000 tons from 110,000 acres). Most of the hay is alfalfa from irrigated land, a small amount is dryland native hay. Wheat is the next crop of importance, followed by sugar beets and other small grains. Approximately 80 to 85 percent of the annual farm income is from livestock and livestock products, the other 15 to 20 percent is from field crops. The average annual net income per acre is approximately $65 for irrigated cropland compared to $22 to $25 for non-irrigated cropland.

The Big Horn National Forest, with 226,000 acres of timber land within the basin, has an allowable annual cut of approximately 7,000,000 board feet of saw timber. Cutting rates, however, during recent years have averaged only about 1,800,000 board feet because of the low demand. The major timber species in the Big Horns are lodgepole pine, Engelmann spruce, Douglas-fir and subalpine fir. Timber from the Custer National Forest, in mid-basin, is of local importance. Figure 16.

Most of the timber outside of National Forest boundaries is non-commercial; occasional isolated high-plateau stands of ponderosa pine provide limited amounts of saw timber.

Public domain in the Tongue River Basin produces little saw timber. Small quantities of poles, posts, firewood and miscellaneous forest products are cut for use close to their origin.

Minerals

Receipts from sales of mineral products average about $3,000,000 annually. Petroleum, coal, sand and gravel, are important, with petroleum ranked first by a wide margin. Crude oil is exported to refineries outside the basin.

Seven companies have applied for Tongue River water to develop the coal-rich area of the Tongue River Basin. Figure 17. Most of the seven are interested in the coal resources for some type of petro-chemical plant, producing gasoline, oil and related synthetic products. (Appendix B.) One company, however, is considering a power plant.

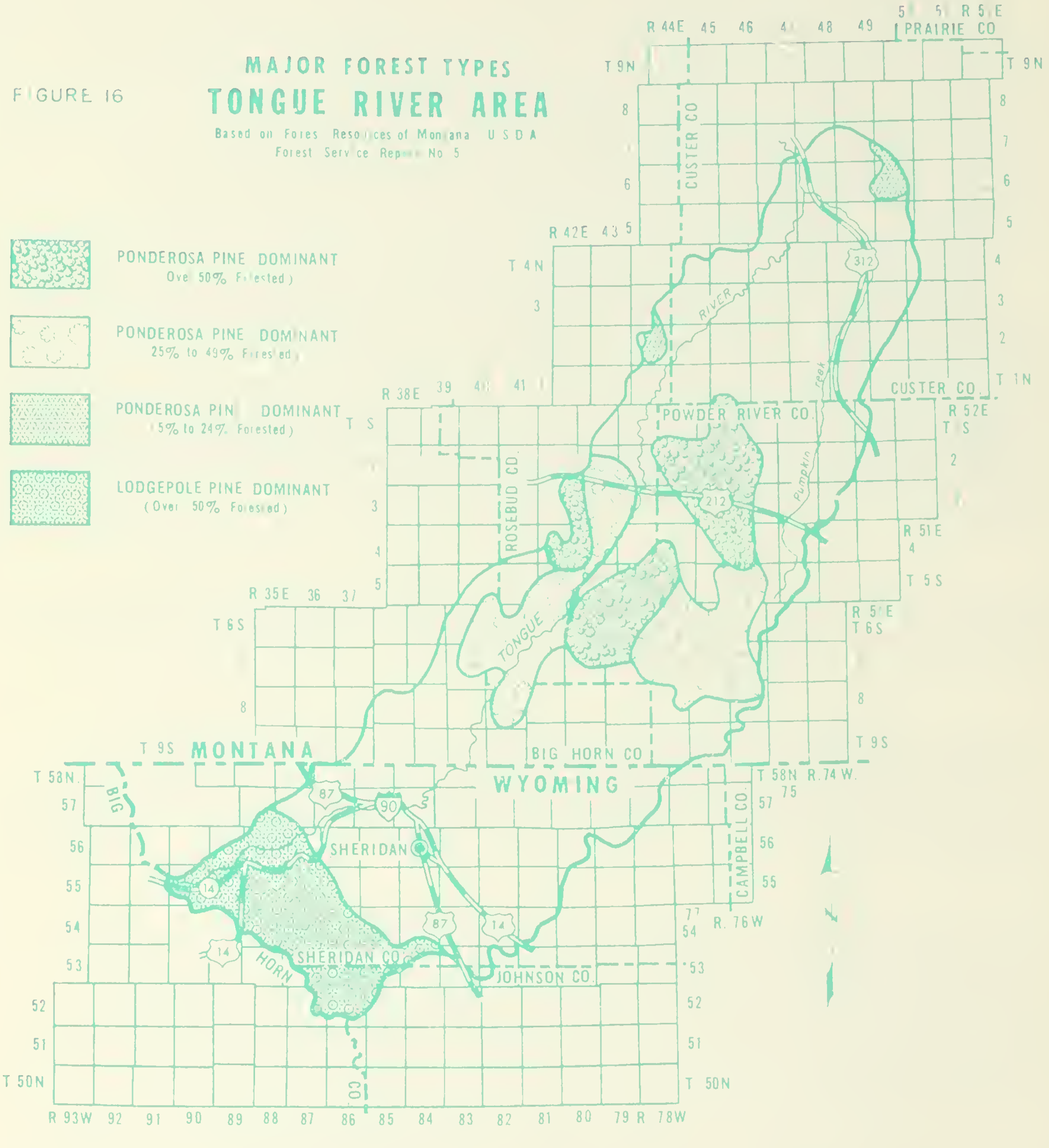
The coal is available in abundant supply. Tongue River water would be used in chemical processes and for cooling; 100,000 acre feet would be adequate. The Tongue River Reservoir holds a maximum of 68,000 acre feet, of this 32,000 acre feet are reserved for irrigators. Approval of the Tongue River Water Users Association is needed before water, excess to irrigation needs, is used for any other purpose.

Water available for industry under one proposed plan would be limited to 15,000 - 16,000 acre feet from the Tongue River Reservoir, the rest of the water would be for agriculture. Pumping water into the area from Yellowtail Reservoir, the Yellowstone River or Powder River is also under consideration. An enlarged or a new reservoir on the Tongue River is also a possibility and has the advantage of being

FIGURE 16

MAJOR FOREST TYPES
TONGUE RIVER AREA

Based on Forest Resources of Montana U S D A
Forest Service Report No 5



the closest source of ample water. (The annual average release from the Tongue River Reservoir is 304,000 acre feet; the minimum release was 111,000 acre feet in 1961.)

The development would aid the economy, for estimates run as high as a $300 million development, and employment figures of anywhere between 5,000 to 25,000 people.

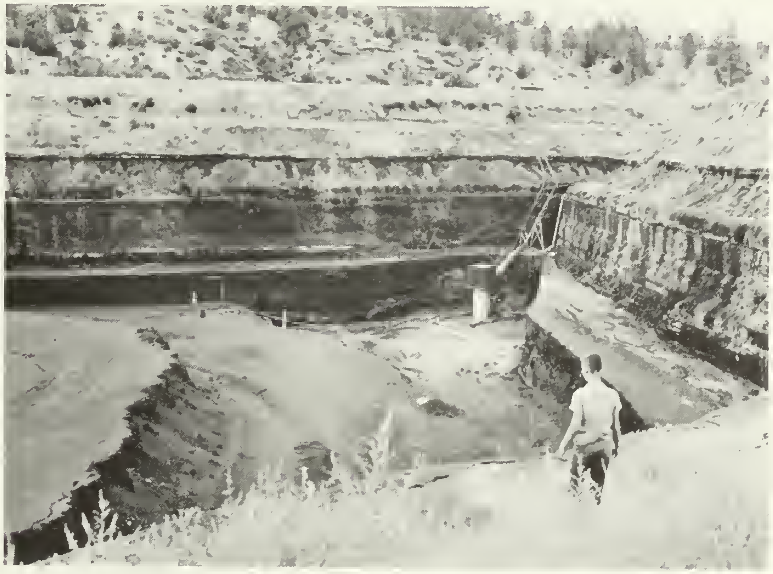


Figure 17 Open pit mine of the Big Horn Coal Company, Sheridan, Wyoming. This 50 foot bituminous coal seam, lying beneath an average of 75 feet of overburden, is a primary industrial resource of the Tongue River Basin. Steam generating plants, refined fuels and chemical products are potential markets for the 1.4 billion tons of coal reserve of the basin.

Transportation and Communication

In the early years, river traffic was the main commercial transportation serving the Tongue River region. By 1874, steam-driven sternwheelers were serving the Yellowstone River as far upstream as Billings, Montana.

When the Northern Pacific Railroad reached Miles City in 1881 transportation by riverboat dwindled.

By 1883 the Northern Pacific Railroad had laid track up the Yellowstone Valley and crossed the divide to the Three Forks of the Missouri and built on into the Pacific Northwest.

The Chicago, Burlington and Quincy Railroad crossed the plains to Sheridan, Wyoming in the 1890's, then extended northwestward along the eastern side of the Big Horn Mountains to the Yellowstone Valley and the Northern Pacific Railroad's main line.

Airlines serve Sheridan, Wyoming and Miles City, Montana connecting with national and international flights at Billings and Great Falls, Montana, Bismark, North Dakota and Denver, Colorado.

Total traffic in 24 hours on all through highways averages about 3,000 vehicles. The heaviest traffic flow is east-west through Miles City on a route along the Yellowstone River. (U. S. 10, 12, Interstate 94.) Carrying about half that amount of east-west traffic is a north-south route along the base of the Big Horns through Sheridan, Wyoming, (U. S. 87, Interstate 90).

Light traffic flow also crosses east-west in mid-basin through Ashland, Montana (U. S. 212). A still smaller traffic flow makes use of a branch off U. S. 212,(U. S. 312), on a north-south route to Miles City, Montana.

These highways are high quality roads. The interior of the basin has gravelled roads surfaced with local slag, an adequate all-weather road system.

Natural gas comes into the basin by private pipeline. A network of private and public power lines provide electricity. Most of the rural area is serviced with electricity and telephone by local cooperative systems.

Commerce and Trade

Within the Tongue River Basin sales and service enterprises produce income second to agriculture.

In 1959 (using the basin counties in their entirety) there were 647 retail sales establishments with recorded sales of $68.3 million. This was an increase of $8 million over 1954. The increase is attributable more to inflation and higher prices than to increased sales volume. The number of retail establishments remained much the same during the five year period.

During the same period 79 wholesaling establishments had total sales of $33.6 million, 327 service enterprises had a gross income of $5.8 million.

In 1961 the basin had between 400 and 500 employees in manufacturing industries and an annual payroll of roughly $2.7 million.

Community Services

One and two-teacher elementary schools are scattered throughout the isolated rural areas. Most of the rural high school students are transported by bus to school or move into town when completing their high school work. Sheridan and Miles City have two-year junior colleges.

Medical facilities are in the larger towns. The Veterans Administration has a hospital for mental patients at Sheridan, Wyoming and a General Hospital at Miles City, Montana.

Retail and wholesale stores and services concentrate in the county seats.

Recreation

The interstate highway system crossing the basin brings tourists from eastern states to the area. In a 1962 census,run by the State of Montana, 42 percent of the tourists entering the state were enroute to Yellowstone National Park. Motels, hotels,restaurants and gasoline service stations all profit from tourism.

Tourists, and local residents particularly, enjoy the fishing, hunting, sightseeing, archeology and "rockhounding". Figure 18. Out-of-state big game hunters are attracted by deer, elk and antelope and in lesser numbers for sharptail grouse and Chinese pheasants. Hunting is good to excellent for all of these.

To illustrate the value of game,each antelope killed brings in about $140 in revenue. The total for the basin is about $80,000 for antelope alone. Monetary values are difficult to assign but hunting brings an approximate annual total of $150,000 into the basin. Fishing brings in comparatively little.

The public domain will be increasingly important in this economic phase - for access to the Tongue River for picnicking and rest stops and some fishing. And for antelope and deer hunting in the plains area of the basin.

Present Economic Conditions and Outlook

The economic growth rates of Wyoming and Montana are much slower than their neighboring states; Wyoming makes a better showing than Montana.

The basin's economic problems are characteristic of an economic shift from farming towards industrial or semi-industrial states. As agriculture, the long-standing primary industry, becomes relatively less important secondary industries replace it or the economy declines.

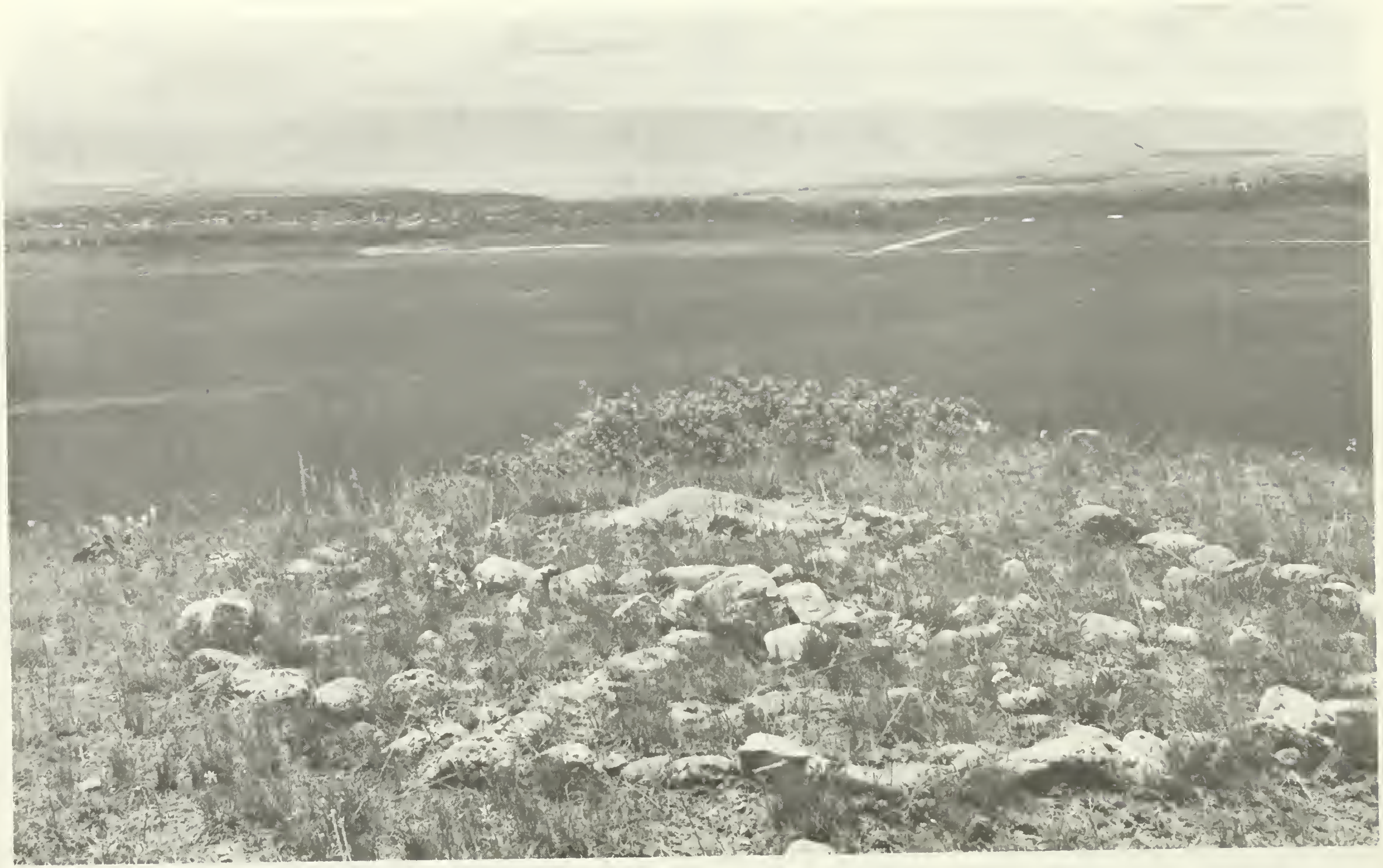


Figure 18 Small prehistoric Medicine Wheel on a ridge three miles east of Sheridan, Wyoming. The Big Horn Mountains are in the distance. The scenic and historic values of the upper Tongue River Area are typified in this photograph.

Agriculture is demonstrating strength and pliability. Farmers and ranchers have new techniques, the operations have grown in size resulting in increased outputs of capital through automation.

One result is an excess of farm labor. Out-migration, during the 1950-60 decade of births over deaths and in-migration, in the basin counties, varied from 10 percent to 20 percent.

The basin needs long range development to offset the decline of agriculture and coal mining. Both States need new jobs for their people or continue to release the labor to other areas. This means new investments and new capital as now seems possible by petro-chemical industries using Tongue River water, Tongue River Basin coal and Yellowtail Dam power.

THE PUBLIC LANDS

Characteristics and Administration

One hundred and eighty-one thousand acres of public lands are administered by the Bureau of Land Management in the Tongue River Basin. The use and disposition of these lands are governed by the Taylor Grazing Act of June 28, 1934,(48 Stat. 1272; U. S. C. 315), as amended, and other applicable public land laws. A recent law of marked significance in their administration is the Multiple Use Management Act of September 19, 1964, (78 Stat. 988).

These are federal lands, originally acquired under the Louisiana Purchase, which have never been alienated to private use through operation of the public land laws, nor withdrawn from entry for a federal management program. The federal lands lie mostly in a scattered pattern throughout the basin, in small acreages, isolated from each other. This isolation gives them their common name - isolated tracts. By definition of the Taylor Act, an isolated tract contains not more than 1,520 acres. Larger contiguous acreages are not considered to be isolated.

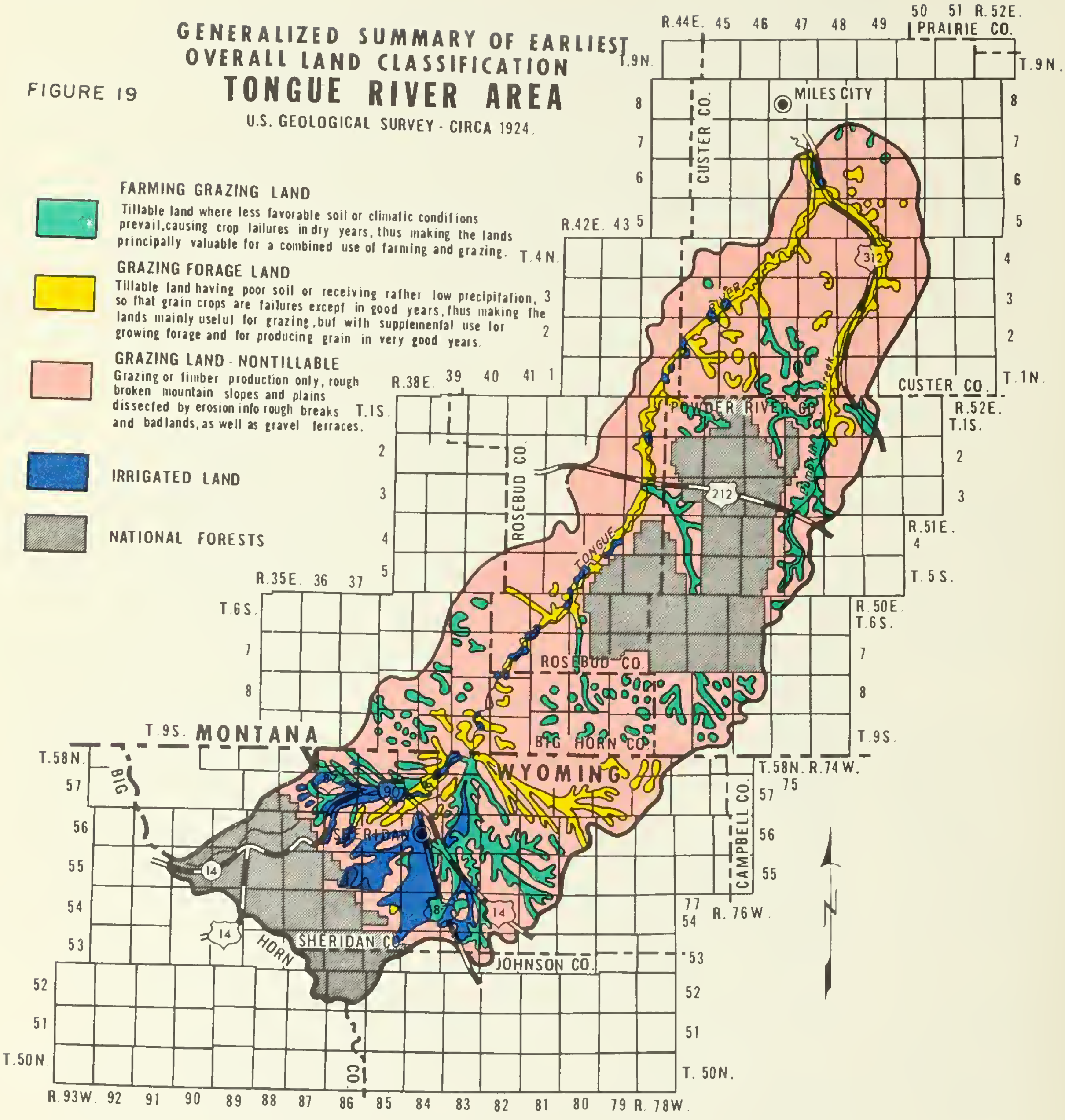
Administration of the public domain in the Tongue River system is the responsibility of the Bureau of Land Management State Directors at Billings, Montana and Cheyenne, Wyoming, for those portions of the basin within their respective States. On-the-ground supervision and management is provided by District Managers and their staffs at Miles City, Montana and Casper, Wyoming.

FIGURE 19

GENERALIZED SUMMARY OF EARLIEST OVERALL LAND CLASSIFICATION

TONGUE RIVER AREA

U.S. GEOLOGICAL SURVEY - CIRCA 1924.



🟩 **FARMING GRAZING LAND**
Tillable land where less favorable soil or climatic conditions prevail, causing crop failures in dry years, thus making the lands principally valuable for a combined use of farming and grazing.

🟨 **GRAZING FORAGE LAND**
Tillable land having poor soil or receiving rather low precipitation, so that grain crops are failures except in good years, thus making the lands mainly useful for grazing, but with supplemental use for growing forage and for producing grain in very good years.

🟥 **GRAZING LAND - NONTILLABLE**
Grazing or timber production only, rough broken mountain slopes and plains dissected by erosion into rough breaks and badlands, as well as gravel terraces.

🟦 **IRRIGATED LAND**

⬜ **NATIONAL FORESTS**

Historic Land Classification Reconnaissance (Circa 1924) 1/

In the period 1890-1920 interest lay in the agricultural capabilities of the Great Plains. In 1924 the U. S. Geological Survey began a reconnaissance study of the northern Great Plains, excluding National Parks and Forests, in which the lands were grouped in three use classes, lands productive under: irrigation, dry-farming, or grazing. Dry-farming lands were in turn divided into three sub-classes: farming, farming-grazing, and grazing-forage lands. Grazing lands were divided into two sub-classes: tillable and non-tillable. Standards of soil, topography and productivity assigned to each class are in Appendix C. The report was published in 1929. A map, figure 19, summarizes graphically the conclusions stated in the Geological Survey report for the Tongue River Area. (Appendix B gives the 1924 comments on vegetation, soils, crops and land classification.)

The inventory of soils and vegetation is notable for the applicability of most of its generalized remarks today. The vegetation has changed little, the soils hardly at all. The percentages of cropland have changed, but not drastically. (One problem on interpretation of the 1924 map is the inclusion of timbered lands under "grazing; non-tillable.")

Range Vegetation

In the rangeland inventory of the Tongue River Basin the general appearance, or aspect, of the rangeland was described by standard range types, such as sagebrush, grassland meadow, etc. (Appendix B.)

Perennial grassland is the dominant range type on public lands in the Tongue River Basin; 145,000 acres, or 80 percent of the land is grass covered. Sagebrush dominates 16,000 acres or 8 percent; coniferous forests of mixed ponderosa pine and Douglas-fir dominate 9,000 acres or 5 percent; junipers and annual plants each dominate 5,000 acres or 3 percent; the remaining 1 percent consists of minor acreages of meadows, browse, swamps and rocky areas. (Figure 20.)

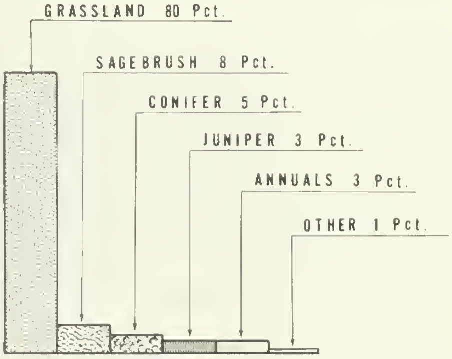


Figure 20 Range Types

1/ This report was reproduced in 1929 by mimeograph in relatively few copies. The attendant maps, printed earlier, are in full color.

(Note: Range types are mapped by vegetative aspect; timber types by tree species. Thus a light stand of timber might be listed as a plant species on a range writeup and the timber written up as accessory notes. Acreages of timber types and range types mapped separately will not agree.) See Appendix C.

In evaluating range vegetation each plant was listed by its frequency of occurrence. A frequency listing shows only one fact, that a plant has occurred in a writeup regardless of quantity of forage produced.

Forage production, another value, is a quantitative measurement. Quantities were expressed as the percent of total forage production of any given plant on one range site. Fifteen percent of total forage production was chosen as being significant in the relative importance of individual plant species. 1/ Both plant frequency and relative forage production amounts are shown in figure 21.

Eighty-five species and genera of plants were recorded on the public domain. Of these only 15 were found in sufficient abundance to amount to as much as 15 percent of the total plant cover on a range site. Two-thirds of the plants identified occurred on less than one range site in ten.

The two most common grasses in the Tongue River Basin were western wheatgrass and blue grama; each of them had a 95 percent frequency of occurrence on the range sites. Western wheatgrass totaled 15 percent or more of total plant production on 40 percent of the range sites; for blue grama the figure was 46 percent of the range sites.

Needleandthread grass on 87 out of 100 range sites was important as a forage producer (15 percent or more of total forage) only 28 percent of the time. Bluebunch (spiked) wheatgrass was as common as needleandthread, with 87 percent frequency, but produced over twice as much, with 62 percent of the range sites having it in quantities of 15 percent or more of total production. Annual grasses, mainly sixweeks fescue and annual bromes, were found on 87 percent of the range sites, but produced 15 percent or more of the total forage on only 27 percent of the sites.

Big sagebrush was wide-spread, on 85 out of every 100 range sites, but it had very low productivity for such a high frequency, making up 15 percent or more of the total plant production on but eight percent of the range sites.

Sedges occurred on 85 percent of the range sites; but forage

1/ This figure cannot be confused with ground cover density which was determined but proved to be of little significance.

FIGURE 21 PLANT FREQUENCIES (NUMBER OF TIMES A PLANT WAS LISTED AS PRESENT IN ANY QUANTITY IN 826 WRITEUPS)

Continued on next page.

COMMON NAME	SCIENTIFIC NAME	NO. OF OCCURRENCES
WESTERN WHEATGRASS	AGROPYRON SMITHI	781
BLUE GRAMA	BOUTELOUA GRACILIS	780
NEEDLE-AND-THREAD	STIPA COMATA	719
BLUEBUNCH WHEATGRASS	AGROPYRON SPICATUM	714
ANNUAL BROMES	BROMUS SPP.	714
BIG SAGEBRUSH	ARTEMISIA TRIDENTATA	705
SEDGES	CAREX SPP.	687
SANDBERG BLUEGRASS	POA SECUNDA	655
PRICKLYPEAR	OPUNTIA SPP.	527
JUNEGRASS	KOELERIA CRISTATA	443
BROOM SNAKEWEED	GUTIERREZIA SAROTHRAE	433
SILVER SAGEBRUSH	ARTEMISIA CANA	407
FRINGED SAGEBRUSH	ARTEMISIA FRIGIDA	404
SQUAWBUSH (SKUNKBUSH)	RHUS TRILOBATA	365
LITTLE BLUESTEM	ANDROPOGON SCOPARIUS	360
GREEN NEEDLEGRASS	STIPA VIRIDULA	356
PONDEROSA PINE	PINUS PONDEROSA	337
JUNIPER	JUNIPERUS SPP.	319
SIDEOATS GRAMA	BOUTELOUA CURTIPENDULA	311
PRAIRIE SANDREED	CALAMOVILFA LONGIFOLIA	296
YUCCA	YUCCA SPP.	294
SIXWEEKS FESCUE	FESTUCA OCTOFLORA	243
PLAINS MUHLY	MUHLENBERGIA CUSPIDATA	236
BLACK GREASEWOOD	SARCOBATUS VERMICULATUS	220
WINTERFAT	EUROTIA LANATA	174
DESERT SALTGRASS	DISTICHLIS STRICTA	158
RED THREEAWN	ARISTIDA LONGISETA	156
INDIAN RICEGRASS	ORYZOPSIS HYMENOIDES	146
SHADSCALE	ATRIPLEX CONFERTIFOLIA	120
PURPLE THREEAWN	ARISTIDA PURPUREA	100
ALKALI SACATON	SPOROBULUS AIROIDES	92
RABBITBRUSH	CHRYSOTHAMNUS SPP.	67
BUFFALOGRASS	BUCHLOE DACTYLOIDES	62
LITTLE BARLEY	HORDEUM PUSILLUM	49
ROSE	ROSA SPP.	48
NEEDLEGRASS	STIPA SPP.	42
IDAHO FESCUE	FESTUCA IDAHOENSIS	35
SNOWBERRY	SYMPHORICARPOS SPP.	34
SAND DROPSEED	SPOROBOLUS CRYPTANDRUS	33
PLAINS REEDGRASS	CALAMAGROSTIS MONTANENSIS	31
TUMBLEGRASS	SCHEDONNARDUS PANICULATUS	31
BLUEGRASS	POA SPP.	30

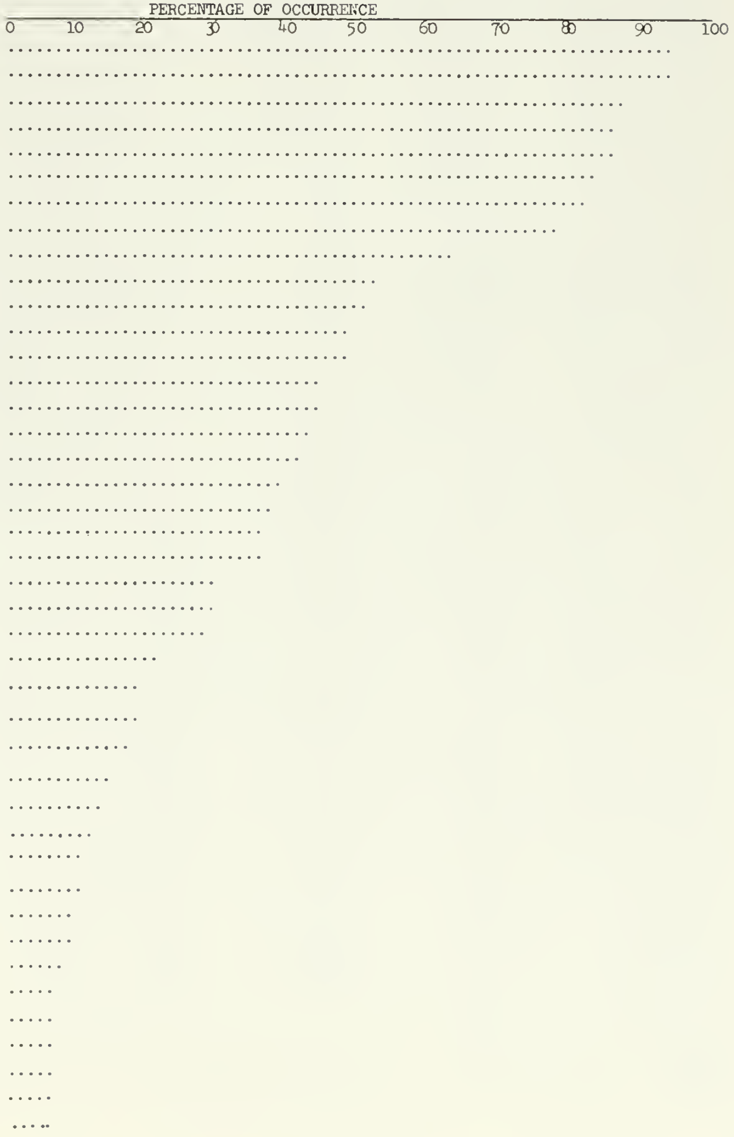


FIGURE 21 (Continued)

COMMON NAME	SCIENTIFIC NAME	NO. OF OCCURRENCES	PERCENTAGE OF OCCURRENCE 0 10 20 30 40 50 60 70 80 90 100
SQUIRRELTAIL	SITANION HYSTRIX	28	...
WHEATGRASS	AGROPYRON SPP.	28	...
GARDNER SALTBUSH	ATRIPLEX GARDNERI	27	...
CHOKECHERRY	PRUNUS SPP.	25	...
ASH	FRAXINUS SPP.	23	...
FOXTAIL BARLEY	HORDEUM JUBATUM	21	..
FOURWING SALTBUSH	ATRIPLEX CANESCENS	16	..
KENTUCKY BLUEGRASS	POA PRATENSIS	16	..
PLAINS COTTONWOOD	POPULUS SARGENTI	16	..
MAPLE	ACER SPP.	15	..
GREAT BASIN WILDRYE	ELYMUS CINEREUS	15	..
SHEEP FESCUE	FESTUCA OVINA	14	..
*GREEN SAGEBRUSH	ARTEMISIA CAMPESTRIS	13	..
CURRANT	RIBES SPP.	13	..
WILLOW	SALIX SPP.	13	..
COTTONWOOD	POPULUS SPP.	12	..
BIG BLUESTEM	ANDROPOGON GERARDI	10	.
SLENDER WHEATGRASS	AGROPYRON TRACHYCAULUM	9	.
CURLLEAF MOUNTAIN-MAHOGANY	CERCOCARPUS LEDIFOLIUS	9	.
ERIOGONUM	ERIOGONUM SPP.	8	.
CANADA WILDRYE	ELYMUS CANADENSIS	8	.
SAGEWORT	ARTEMISIA LUDOVICIANA	7	less than 1.0%
QUAKING ASPEN	POPULUS TREMULOIDES	7	less than 1.0%
BUFFALOBERRY	SHEPHERDIA SPP.	7	less than 1.0%
GREEN-MOLLY	KOCHIA AMERICANA	6	less than 1.0%
FALSE BUFFALOGRASS	MUNROA SQUARROSA	6	less than 1.0%
THICKSPIKE WHEATGRASS	AGROPYRON DASYSTACHYUM	4	less than 1.0%
SPIKE FESCUE	HESPEROCHLOA KINGI	4	less than 1.0%
MUTTONGRASS	POA FENDLERIANA	4	less than 1.0%
ALPINE FIR	ABIES LASIOCARPA	3	less than 1.0%
SALTBUSH	ATRIPLEX SPP.	3	less than 1.0%
WILDRYE	ELYMUS SPP.	3	less than 1.0%
REDTOP	AGROSTIS ALBA	2	less than 1.0%
SMOOTH BROME	BROMUS INERMIS	2	less than 1.0%
HAWTHORN	CRATAEGUS SPP.	2	less than 1.0%
SWITCHGRASS	PANICUM VIRGATUM	2	less than 1.0%
CHERRY	PRUNUS SPP.	2	less than 1.0%
PURPLE PINEGRASS	CALAMAGROSTIS PURPURASCENS	1	less than 1.0%
ROCKY MOUNTAIN CLEMATIS	CLEMATIS OCCIDENTALIS	1	less than 1.0%
RUSH	JUNCUS SPP.	1	less than 1.0%
WITCHGRASS	PANICUM CAPILLARE	1	less than 1.0%
PRAIRIE CORDGRASS	SPARTINA PECTINATA	1	less than 1.0%

* STANDARDIZED PLANT NAMES - COMMON NAME SAGEWORT WORMWOOD

production was low with only 14 percent of the sites having sedges in quantities of 15 percent of total production. Sandberg bluegrass was found on 79 out of 100 range sites; this low, early-maturing grass produced little forage, however, only 20 percent of the sites had it in quantities of 15 percent or more of total production.

Pricklypear, a common noxious plant, wide-spread at the time of the early explorers, is still common, occurring on 64 out of 100 range sites but never did it aggregate 15 percent of the total plant production on any site.

Junegrass, a palatable range species, is also common, occurring on 54 percent of the range sites but it produced little forage volume as it never accounted for 15 percent of the plant production.

The limiting effects of environment in the Tongue River Basin can be inferred by the frequencies of the 85 plants listed in figure 21.1/ In figure 21, palatable and unpalatable plants intermingle without relation to their acceptability to livestock. The relatively good state of range plant condition found on the public domain leads to the conclusion that the existing plant frequencies are largely due to soil and plant-water relationships.

Range Condition

The most sensitive and accurate indicator of range condition is the total plant cover. The ecological method used in this inventory evaluates plant cover by range sites - mappable areas with significant differences in soil depth, soil texture, soil permeability, topography or forage production. The original plant cover for each range site is determined by studying protected and well-managed rangelands. Condition can then be related to any departures (0%-100%) from the percentage of original plant species. Range condition is given as: "Excellent" (75% to 100% of original); "Good" (50% to 75% of original); "Fair" (25% to 50% of original); "Poor" (0% to 25% of original).

A range site in "Excellent" condition is in close accord with its original plant cover. The next lower class, "Good" represents

1/ High frequency plants were found to be unrestricted by special environmental requirements, which was not true of the plant species with low frequency. Many of the plants with a low frequency are conspicuous. Roads in the Tongue River Basin usually follow drainages and low ground where cottonwoods, snowberry, wild rose, buffaloberry, saltbush and greasewood abound; these plants appear to be common. Figure 21 shows that they are relatively infrequent.

small changes in which some percentage of the original plants have been changed. Lower condition groups, "Fair" and "Poor" represent greater departures from the original plant cover.

On typical range "Excellent" and "Good" have the more desirable perennial grasses and forbs; forage production is greater; soil cover of mulch and litter will, however, vary with climate and site. In "Fair" and "Poor" condition, forage production is lower because the plants are usually low-growing and many are rejected by livestock.

Under local conditions, particularly on "Fair" condition ranges, the plants may be inferior in quality or quantity to those of the original plant cover, but do furnish forage at a time of critical need. Therefore range in "Fair" condition may be necessary to the range managers.

"Poor" condition is the lowest condition class. The original plant cover may be replaced wholly or in part by other, often undesirable, vegetation. (See Appendix C for details of this method of range inventory.)

Range Condition of the Public Domain

Range condition based on ecology of the range sites was determined on approximately 99 percent of the public domain of the basin. (Water or water surface, amounting to 1.1 percent, approximately 2,000 acres, was not rated.) Of the public domain .3 percent (685 acres) were rated as "Poor" range condition; 16 percent (28 thousand acres) in "Fair" condition; 59 percent (106 thousand acres) in "Good" condition; and 25 percent (46 thousand acres) in "Excellent" condition. Therefore, approximately 83 percent of the public domain in the basin is producing range forage above average. Figure 22.

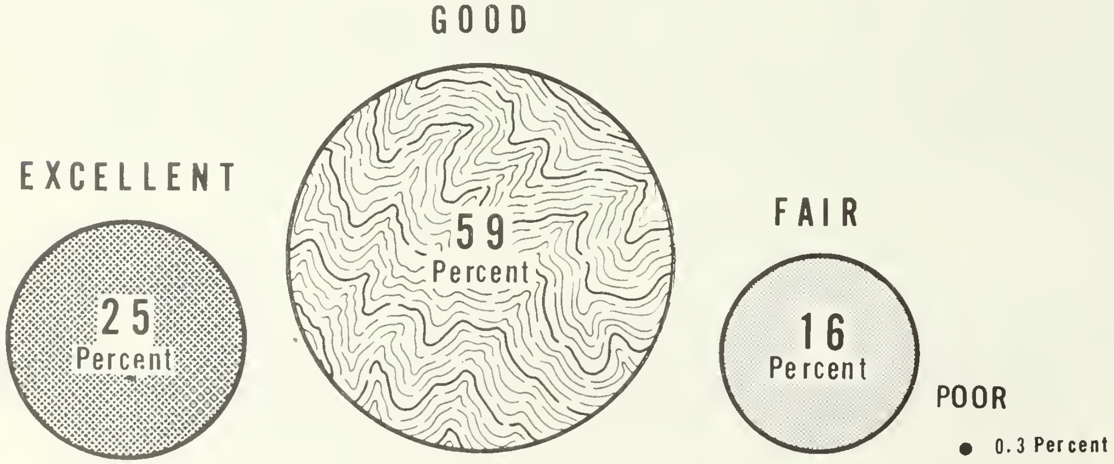


Figure 22 Range Condition

Land Capabilities and Classes

Land capabilities express the limits of lands for long-time safe, economical production. Government agencies commonly group land capabilities into eight broad classes from Class 1 to Class VIII. The capability of each is determined by soil depth, texture, fertility, slope, length of slope and erodibility, as they are weighed against long-term production without soil damage.

Class I, II, III and IV are all cultivable. Class I soils are deep, level, fertile and grow any agricultural crop within the limits of the local climate. Class II soils require a few precautions in farming to protect the soil from erosion, maintain the tilth, and keep up the level of fertility. The higher the class the greater the management problem is. Soils of Class IV, in the Tongue River Basin, include those on the dryland farms where fallow and strip cropping combat the limitations of the climate.

Land capability Class V falls between the two major groups of soils, those soils suited to cultivation and those soils always in permanent cover. Class V lands may be level with deep soils but not cultivable because of frequent river overflow, or because rockiness bars the use of farm machinery.

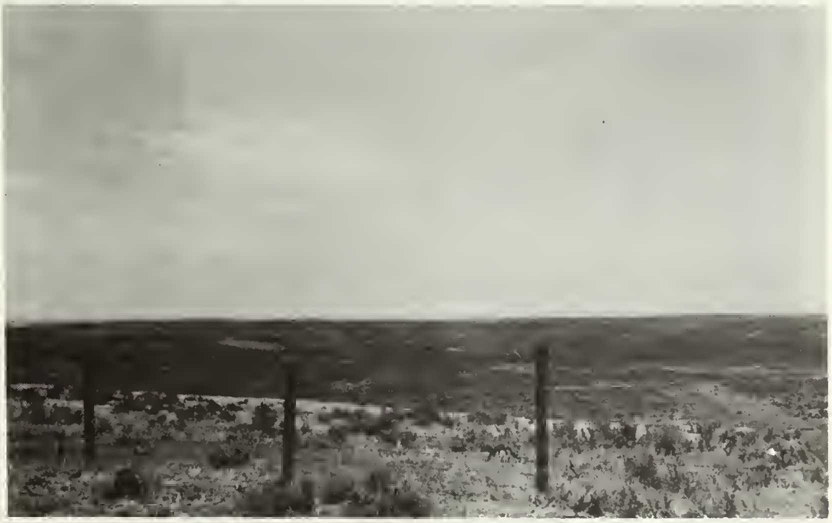


Figure 23 Land capability Class VI. Soils of Class VI are restricted to permanent native plants and used for forage and cover by wildlife and livestock. No restrictions other than good range management are needed. Photograph is of the level plains in the higher elevations of the southern part of the basin.

Most of the lands of the Tongue River Basin, and nearly all of its public domain, have soils which must be kept in permanent plant cover. The best of these are in Class VI, (figure 23), where the level relatively deep and fertile soils require only good range or timber management practices for continued use. Class VII, figure 24 , includes those soils with increasing hazards of use because of steeper topography, shallow soils, soils with unstable textures or concentrations of salts. Rangeland in Class VII is restricted to lighter grazing than on Class VI land.

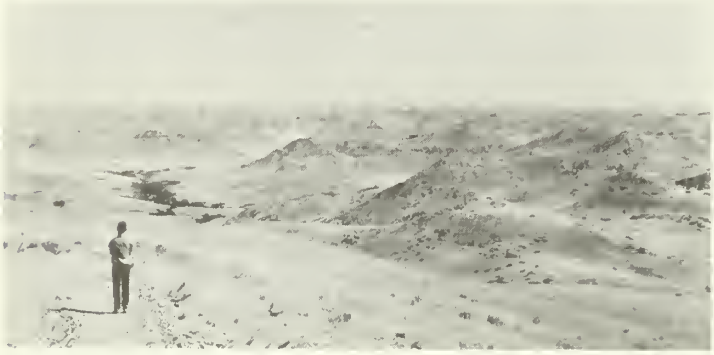


Figure 24
Land capability Class VII. Steep, rocky, productive grassland range. The hillocks are formed by red slag, or scoria, typical of southern and central parts of the basin. Steep slopes restrict grazing of Class VII land to a lighter use.

At the extremes of land capabilities lie the interesting and often unusual Class VIII lands. These include marshes, steep rugged mountains and barren badlands. Wildlife values are often high, as are the associated recreational uses of hiking, picnicking or rockhounding. See figure 25 below.

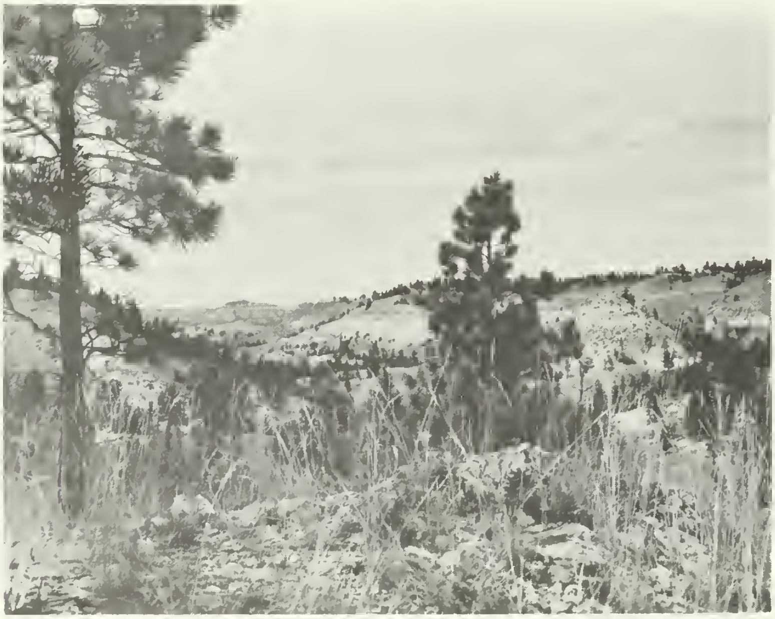


Figure 25 Land capability Class VIII. Very steep slopes, easily erodible soils and excessive rocky outcrops make this Class VIII land. Livestock use is limited but this area is ideal for wildlife, for cover and forage. Class VIII is often attractive with a high potential for recreation. This scene is of an isolated tract of public domain typical of the rugged central part of the Tongue River Basin.

Capabilities of the Public Lands

Seventy percent of the isolated tracts of the Tongue River Basin are in land capability Class VII. Class VI lands make up 27 percent of the isolated tracts. Class VIII lands comprise 2 percent of the public domain. The remaining 1 percent is distributed between arable land and other miscellaneous classes. Figure 26.

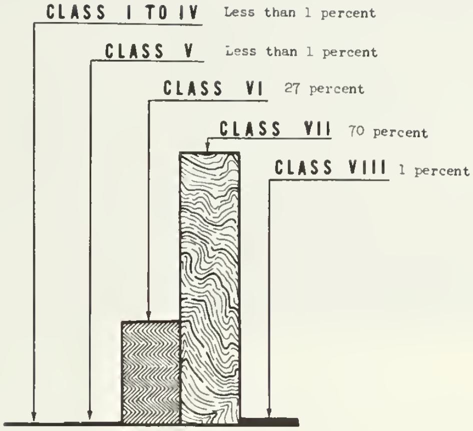


Figure 26 Land Capability Classes

About 25 percent of the isolated tracts are Class VI; adapted to livestock or timber production without significant restrictions. Less than 1 percent of the public domain has a capability suited to cropland. Almost 75 percent of the total acreage of the isolated tracts is suited to livestock grazing with appropriate restrictions, Class VII, or can be safely used only by wildlife, Class VIII.

Soil Erosion

Most of the erosion in the Tongue River Basin is a natural geologic process. Larocque, 1805, and Clark, 1806, both remarked on the muddy waters of the lower Tongue River.

At its lowest point, the Tongue River Valley is broad, and the slopes are gentle. Extending up the basin the valleys have a level base, incised by scattered V-shaped gullies heading below the upland rocky ridges and spurs. Figure 27. In the middle reaches of the Tongue River Valley remnants of the former valley level floor are preserved as small clay mesas rising 10 to 15 feet above their present base. Figure 28. In the sandstones of the central basin the valleys narrow, only to widen into shallow troughs in the upper levels of the basin. Still farther upstream,in a relatively small zone, are the precipitous east slopes of the Big Horns.

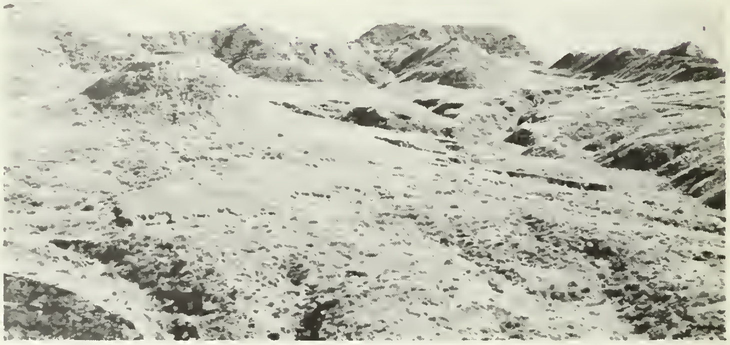
The original Tongue River plain extends out in a system of ridge tops and buttes from the common level of the high country to the south; the broken terrain has been formed by geologic erosion. In the valleys stabilization was once achieved, but in recent geological periods, cutting recommenced, then stabilized. At present the gullies seem relatively stable.

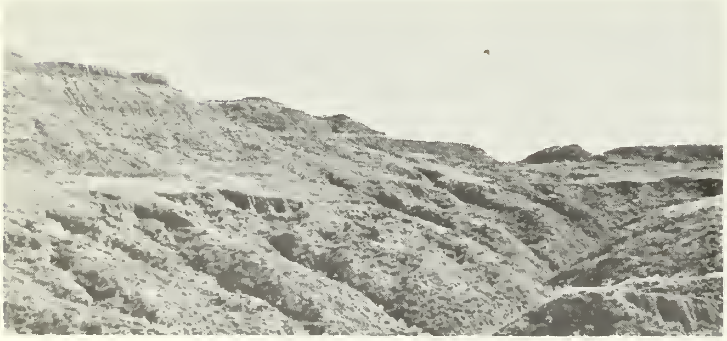
Ninety percent of the Tongue River Area developed on a level plain. Dissected by shallow valleys, its terrain is rugged - the old plain is seen in the tops of its ridges and buttes.

A

Wide broad valleys have been cut and filled. Ten-thousand-year-old buffalo bones are often exposed 12 to 15 feet below the general valley floor. The level floors of most arroyos indicate stabilization in this cycle.

B





This valley shows recent but stabilized V-shaped cuts below its general level. Erosion by piping, explained in Appendix B, is evident in the left foreground of both "B" and "C" in abrupt small scarps.

C

Figure 27 Tongue River Area varies throughout its length. Accelerated erosion is of infinitely less importance in terrain development than is geological erosion. Most of the plains terrain is rough. Capped by erosion-resistant red scoria ridges above, the valleys are low and in mid-basin are very steep sided. Topography favors wildlife, livestock and native vegetation.

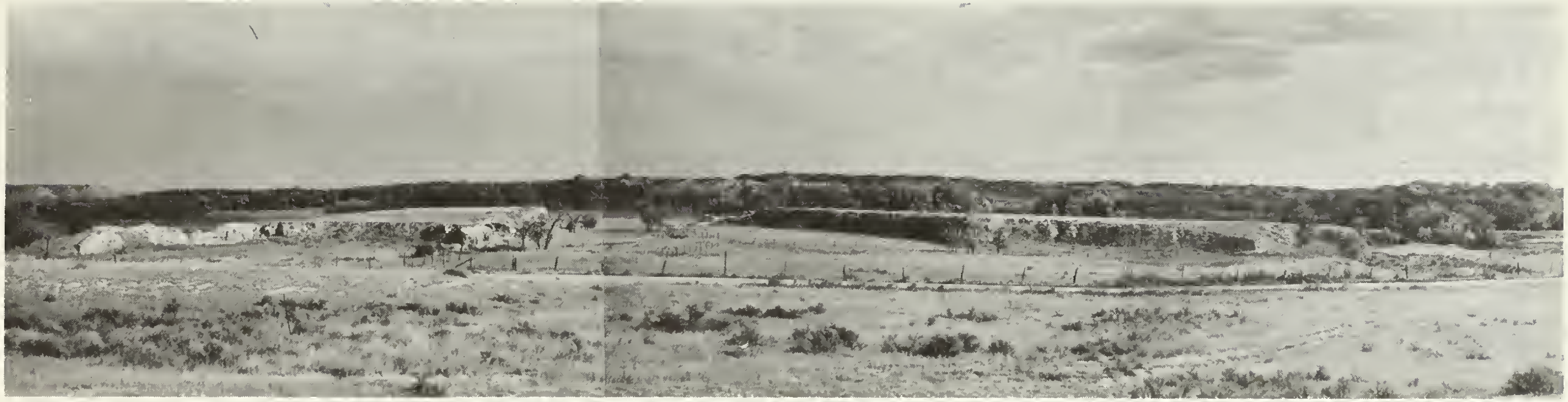


Figure 28 The foreground, the land immediately beyond the fenced road, and the prominent low mesa-like remnants of the former valley surface in mid-distance are on the same level. The Tongue River flows along the band of cottonwoods, at mid-distance, about twelve feet below the valley floor. On the skyline are the red-colored buttes and rough pine-covered breaks that makes this section of the Tongue River attractive.

The basin passes through periods of stabilization and active cutting.

Geologic erosion also affects the public domain in degrees varying from light to severe. This erosion is normal - but it may be a problem in land management, in maintenance of water quality, in construction, and require management decisions and programs - and it is an inseparable part of the landscape.

Accelerated erosion is soil loss at rates greater than normal geological erosion. 1/ The most common reason is the use of land beyond its capability. Accelerated erosion results from action of the two principal eroding agents, wind and water. It can often be corrected or alleviated.

Accelerated erosion can start from too early grazing, overstocking, lumbering, fire, concentration of water from roads or denudation from construction, any of which may remove or weaken the protective cover on the soil. Accelerated soil erosion can be a product of nature; landslip and slides from heavy rains, destruction of soil cover by prolonged drouth, earthquakes, etc.

Erosion in this report shows the varying loss of topsoil by accelerated erosion by Class 1 through 4.

Class 1 represents none to slight erosion. This is, as encountered in the field, almost undetectable. Class 2 erosion is readily apparent in field examination, soil loss may equal three-fourths of the "A" horizon of a mature soil, or, in a structureless soil, three-fourths of the top five inches; rills are widespread, small gullies common. Class 3 erosion indicates moderate to severe soil loss. The "A" horizon of the average mature soil is gone; the top five inches or more of a structureless soil is gone. Gullies are large and deep, often dendritic and usually impossible to cross with farm machinery. Class 4, severe erosion, attains to the status of land forms.

Soil loss on public domain lands of the Tongue River Area by water action is small, figure 29. Over half the public domain has none to slight soil loss, 52 percent in Class 1, an additional 42 percent has but slight to moderate soil losses in Class 2. Only 6 percent of the public domain has soil losses in the moderate to severe Class 3.

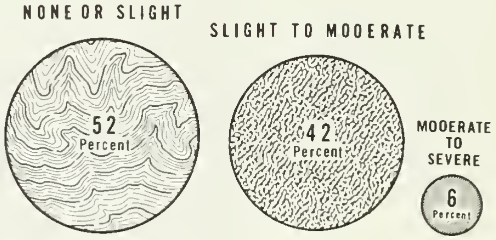


Figure 29 Accelerated soil erosion loss from water in the Tongue River Basin public domain

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1/ Geological erosion is a problem on many tracts, especially on badlands, but this is inherent in the tract.

Soil loss on public domain in the Tongue River Area by wind action is almost negligible because of its rugged terrain. Soil loss in Class 1, none to slight,is 93 percent; Class 2, slight to moderate, is but 7 percent; and Class 3, moderate to severe, is negligible. See figure 30.

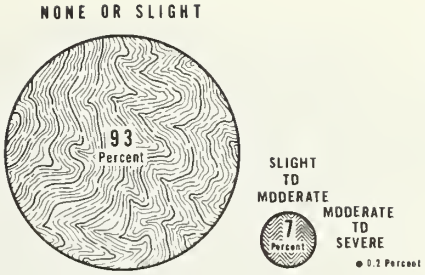


Figure 30 Accelerated soil erosion loss by wind action.

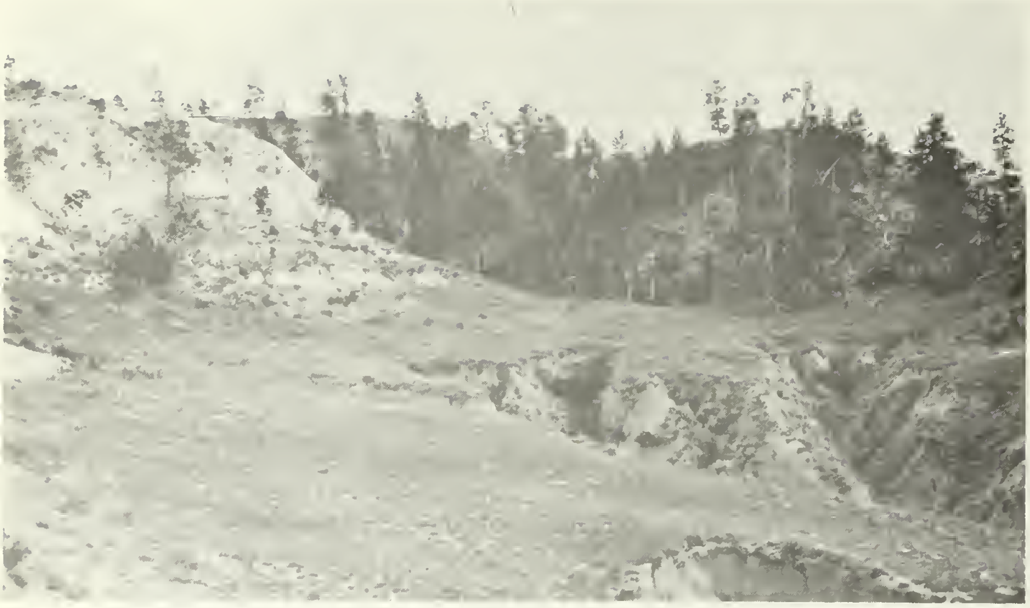
Approximately 96 percent of the public domain loses little soil by accelerated erosion; this is not unexpected because of the perennial grass or timber cover. Most of the Class 3 or 4 erosion is created by runoff from adjacent lands. Areas of severe geological erosion occasionally contribute to accelerated erosion with quick water runoff onto the public domain. Appendix B. This requires expensive and complicated control measures beyond the value of the public domain; but extending beyond the public domain in ultimate benefits.

The greatest single reason for the favorable erosion pattern on the public domain is its use within its land capability class.

Despite the favorable soil losses a specialized problem arising in the Tongue River Basin is that of "frail lands". These lands are derived from parent materials with a combination of salt content, certain clays, and topography that favors special erosion. Certain soils high in clay molecules that expand and contract violently, (as much as 700 times in volume), when wetted and dried create difficult problems in protection of structures, water quality, etc. Normal erosion control measures used for accelerated and geologic erosion fail in these soils - actually they will aggravate the problem. See Appendix B on Erosion.

MISSOURI RIVER BASIN PHOTOGRAPHIC STUDIES

Old photographs dating from 1900 to 1930 were relocated for all major types of vegetation and topography. These sites were rephotographed for an analysis of long term trends based on time spans from 40 to 60 years. Two such comparisons are shown in figure 31 and figure 32. The remaining comparisons are in Appendix B where a comparison of trend in the Missouri River Basin (168 pairs of photographs) is made with the Tongue River Area.



U. S. Geological Survey Photograph Circa 1907

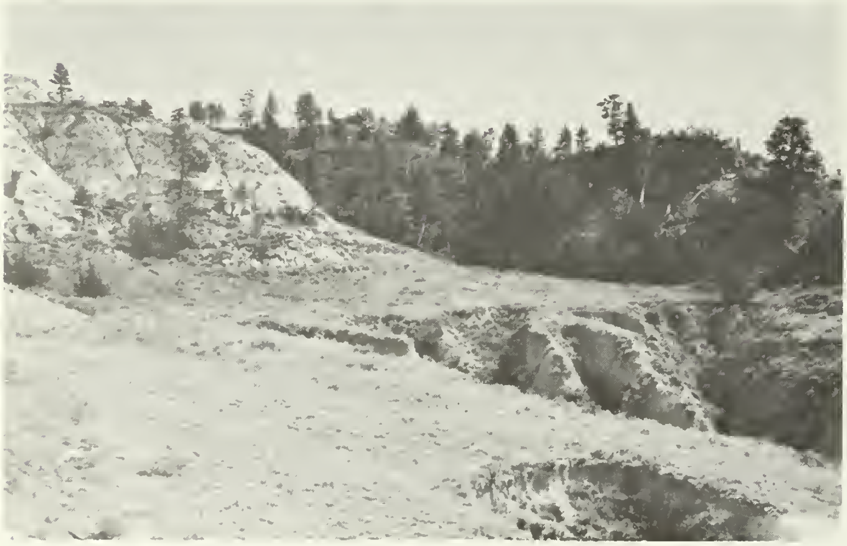
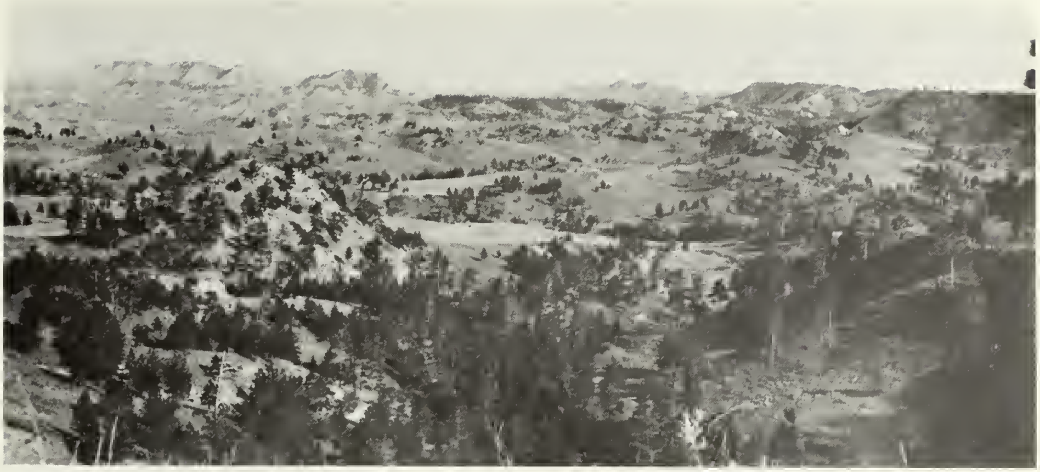


Figure 31 Surprising stability of the vegetation and the gully is evident. Gully walls have stabilized and increasing ground cover is general, particularly on smaller plants in the foreground. Timber on the ridge has increased in size and number of plants. Such stability was also recorded by Dr. Shantz and Dr. Phillips in 1963 for the Northern Great Plains. The original photograph is dated 1907, in actuality it is probably 4 years older (1907 is the report publication date). Sixty years is the realistic interval between the comparisons.



U. S. Geological Survey Photograph Circa 1907

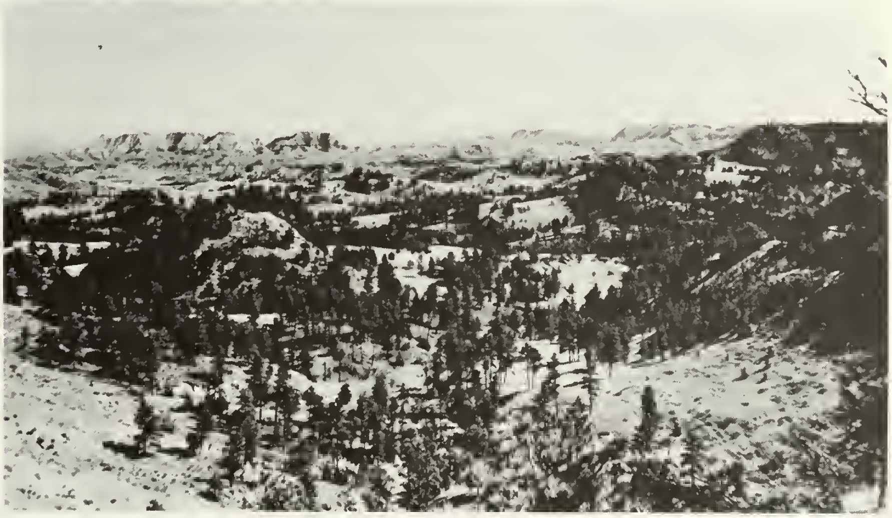


Figure 32 These photographs are southeast of Miles City, Montana, in the lower portion of the Tongue River Basin.

A lessened ground cover is apparent as, for example, on the sagebrush in the lower right of the photographs. Most important, however, the invasion, in the right third of the 1962 photograph, of areas which never supported trees and now have a heavy cover. The implication is a probable minute climatic change. Invasion of trees in the Missouri River Basin is borne out by Missouri River Basin Group comparisons, by Dr. Shantz and Dr. Phillips, Northern Great Plains, and Hastings and Turner, Arizona.

A 55 year time span between these two photographs demonstrates an amazing change in vegetative cover.

Three factors; range cover and condition; timber; and accelerated soil erosion for 20 photographic pairs were used to determine an overall trend of the basin. Figure 33. The photographs showed an upward trend on 31 percent, a stable situation on 54 percent, and a downward trend on 15 percent. This downward trend is mostly a reflection of the innately unstable soils of a part of the lower basin

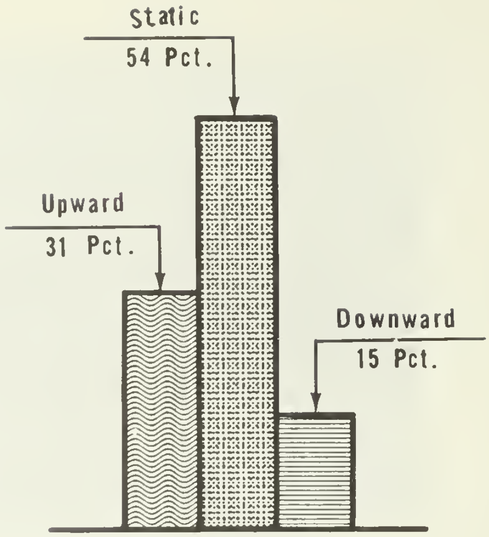


Figure 33 Overall trend for vegetation and erosion. Tongue River Basin. (20 photographic pairs.)

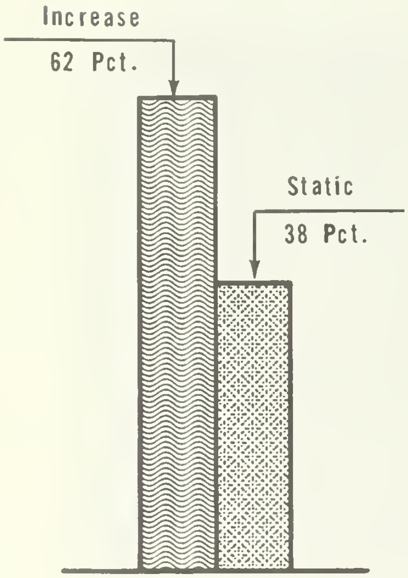


Figure 34 Timber Trend. Tongue River Basin. (20 photographic pairs.)

The most pronounced change is in the coniferous timber. Nearly two-thirds of the photographs with tree cover show an amazing vigor, the trees are not only increasing in size, as would be expected, but also increasing in numbers and, most importantly, invading areas which prior to this have not supported any tree cover. Figure 34.

On the photographs one pair out of the 20 indicated any downward trend in woody vegetation. Browse species such as mountain mahogany and similar brush that normally occupy shallow rocky areas have maintained their cover or slightly increased their areas. On deeper soils, however, this is not true; stability is the rule as with big sagebrush which is the most common browse plant of the basin. See figure 21. Increase, if any, on browse is restricted to those soils with a very favorable plant-soil relationship.

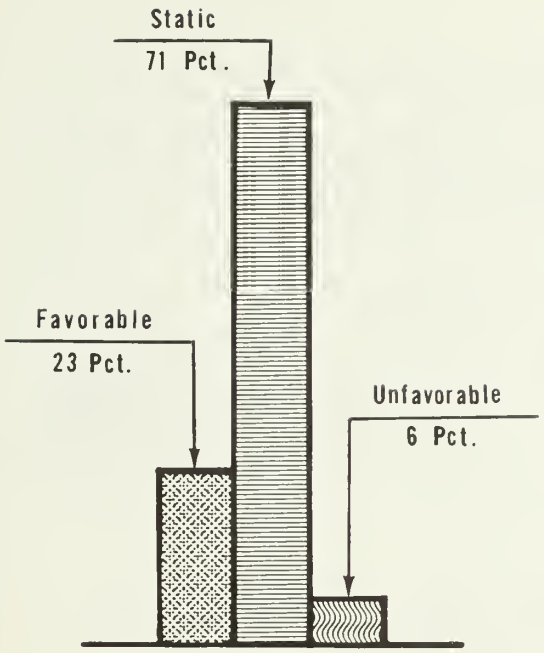


Figure 35 Range Cover Trend.
Tongue River Basin
(20 photographic pairs)

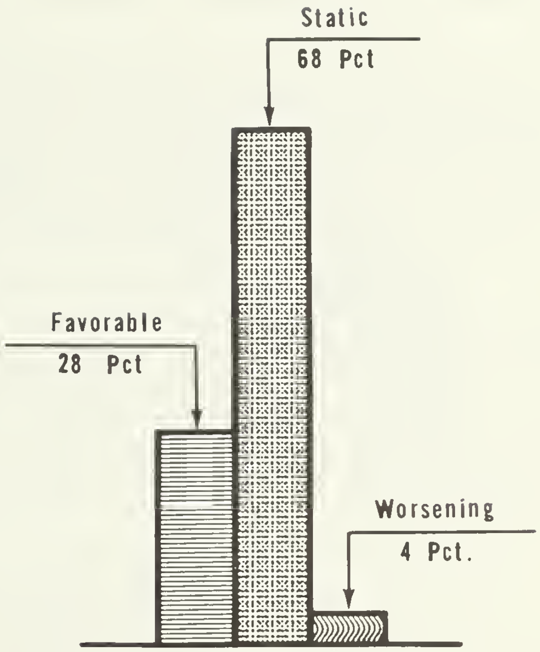


Figure 36 Trend of Accelerated Soil
Erosion by Wind and Water.
Tongue River Basin.
(20 photographic pairs)

The ground cover has definitely increased as shown in Figure 35 on range cover and vegetation. This increase in protective cover is reflected in a low rate of accelerated erosion, for 28 percent of the photographs showed the gullies stablizing and revegetating and but four percent actually are worsening. Figure 36. The majority of the photographs show a stable situation. Some photographs indicate replacement of mid-grasses by perennial short grasses. Usually this is on the somewhat heavier soils with lessened tolerances in plant-soil moisture relationship.

Your own conclusions may be drawn by your study of the photographs in Appendix B. The general stability of accelerated soil erosion and range cover and condition, and a very small increase in the associated browse species shows use and past history does not seem to enter much into the present range condition. A small climatic change rather, too small to be measured by our present instruments, may be the deciding factor in determining how the vegetative resources and the soil resources of the public domain look tomorrow. This is predicated on the definite increase and invasion outward from previously established stands of timber. (This is noted too in the Missouri River Basin comparison of a total of 168 pairs of photographs. Investigators in other States including Arizona, Alaska, and Wisconsin have recognized the same trend.)

CLASSIFICATION AND MULTIPLE USE ACT

By the Classification and Multiple Use Act of September 19, 1964,(PL 88-607), Congress directed the Department of the Interior, among other things, to determine which of the public domain lands were suitable for disposal and which contained values making them more suitable for retention in Federal ownership for interim management under principles stated in the Act.

The determinations called for by Congress are now being made as part of the regular-fund Bureau of Land Management program, under regulations approved by the Department of the Interior. These determinations are administrative actions which appear in final form as Federal Register publications. They are basic tools for use by the Bureau of Land Management in reaching decisions on petitions for change in ownership or management of the land, including suitability for transfer to another public agency.

Formal classifications under the Classification and Multiple Use Act have not yet been completed for the Tongue River Basin. An initial analysis has been made, however, consisting of an internal agency expression of the proposed classification of lands under the Act.

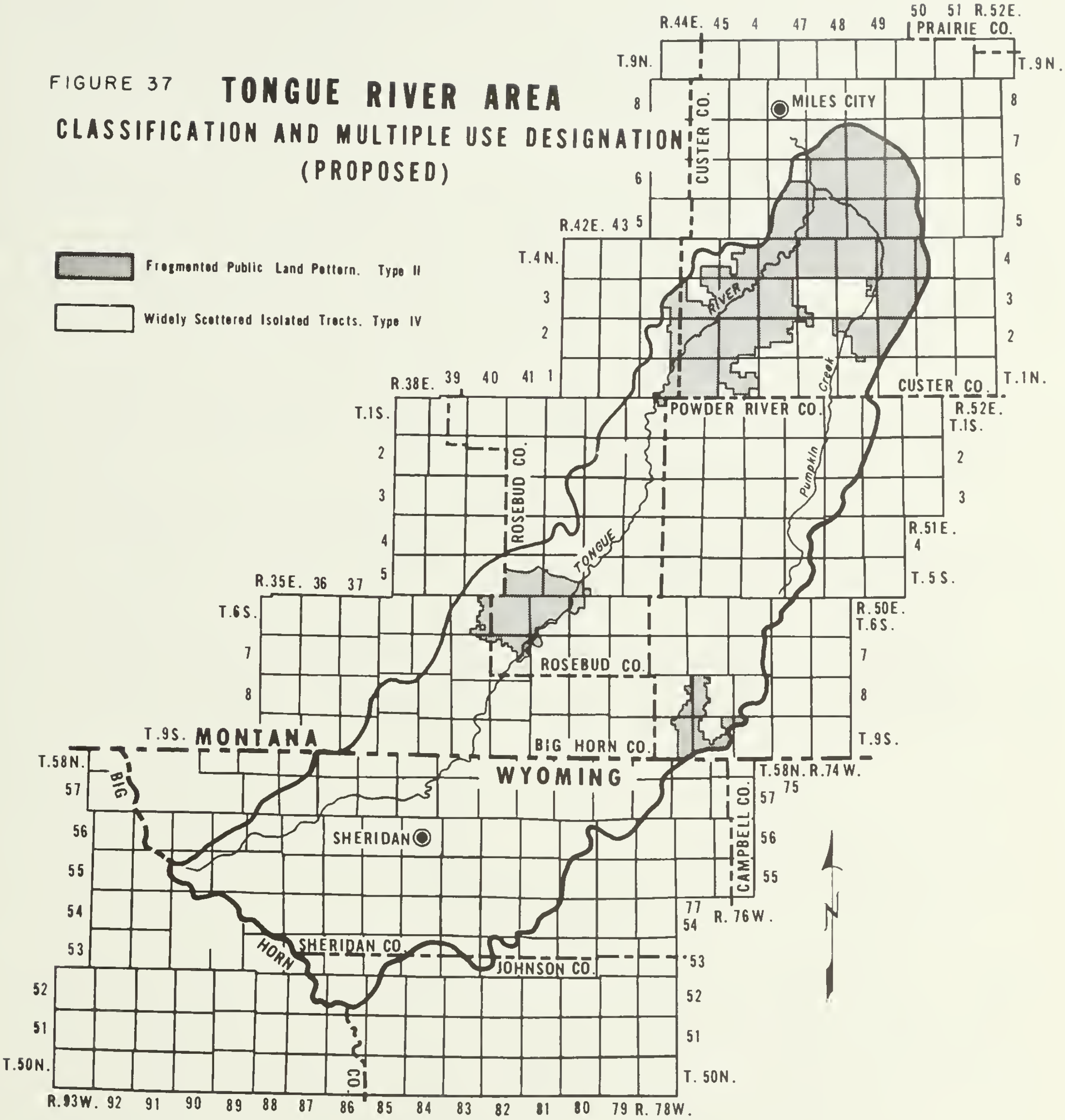
Four categories have been provided under which lands may be designated in the Classification and Multiple Use procedure. Number I provides for retention where well-blocked land patterns and other considerations clearly demonstrate that long-term efficiency of administration will result. Number II is applied to areas of fragmented land pattern in which the objective is to improve management effectiveness. This may be done by consolidation of ownership, by retention of land, or by disposal. Number III is a restricted classification where management is planned for, or in cooperation with another Federal agency. Number IV designates areas where the public domain occurs as widely scattered isolated tracts or areas near expanding communities. The majority of these tracts are regarded as subject to an orderly program of disposal, with interim management pending such action.

In the Tongue River Basin there are two general land patterns. The northern part of the basin, extending from Miles City southward about 40 miles to the Powder River County line plus two small, detached areas in Montana, suits the definition of a fragmented area and have been proposed for classification as a Type II area. The remainder of the basin is under consideration for a Type IV designation due to the isolated character of the public land holdings. Figure 37. Before a classification can be made, a Notice of Intent is published, local publicity is given, meetings of interested parties are held and a public hearing conducted.

FIGURE 37

TONGUE RIVER AREA

CLASSIFICATION AND MULTIPLE USE DESIGNATION (PROPOSED)



▨ Fragmented Public Land Pattern. Type II
☐ Widely Scattered Isolated Tracts. Type IV
MILES CITY
SHERIDAN
TONGUE RIVER
Pumpkin Creek
BIG HORN
MONTANA
WYOMING
CUSTER CO.
PRAIRIE CO.
POWDER RIVER CO.
ROSEBUD CO.
BIG HORN CO.
CAMPBELL CO.
SHERIDAN CO.
JOHNSON CO.
CO.
R.44E. 45 4 47 48 49 50 51 R.52E.
T.9N. 8 7 6 5 T.4N. 3 2 T.1N.
R.42E. 43
R.38E. 39 40 41 1
T.1S. 2 3 4 5 T.6S. 7 8 T.9S.
R.35E. 36 37
R.52E. T.1S. R.51E. 4 T.5S. R.50E. T.6S.
T.58N. 57 56 55 54 53 52 51 T.50N.
T.58N. R.74W. 75 77 R.76W.
R.93W. 92 91 90 89 88 87 86 85 84 83 82 81 80 79 R.78W.

RECOMMENDATIONS ON THE PUBLIC DOMAIN

In day-to-day Bureau of Land Management terminology the term "Land Classification" is used in the sense of approval for a change in ownership or management, including suitability for transfer to administration of another public agency. Classification of land within that context is made by an authorized officer of the Bureau of Land Management under the authority of one of the public land laws.

In the present study the personnel have no authority to classify lands in the manner just described, although their work incorporates the basic data found in most formal classification reports. The term "classification", and variations of the word, are thus used in this report within the limitation of classification in a technical sense, as contrasted to classification of land in the administrative sense.

In the study of the Tongue River Basin, 764 isolated tracts of vacant public domain aggregating 143,500 acres were examined and classified. Of those lands, 88,000 acres were classed as best suited for retention in public ownership.

The remainder, 55,500 acres, were recommended for management by individuals. At this time 3,500 acres of this total have been transferred to private ownership.

Appendix A summarizes the individual classifications. The detailed narratives and maps of each isolated tract are on file with the Bureau of Land Management at Miles City, Montana, Casper, Wyoming and the Denver Service Center.

APPENDIX A

Summaries of Isolated Tract Inventory

Appendix A -- Description, classification of suitability, and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

Introduction

The following information, in tabular form, summarizes inventory findings tract by tract. The public domain in the Tongue River Area occurs in several patterns. Where this pattern was one of a small acreage of public domain scattered through a predominantly private and state ownership, the land was inventoried and classed as isolated tracts. These findings, upon conclusion of the inventory, were forwarded to the appropriate District Office.

Of the 142,000 acres listed in the following tables, approximately 90,000 acres were evaluated as being best suited for retention and management in public ownership. Approximately 52,000 acres were considered to have characteristics making them best suited to disposal. Between the time of field inventory, and publication of this report, about 3,500 acres were disposed of pursuant to Land Classification programs of the agency.

Note: The material in the tables is self-explanatory with the exception of the numbers in the columns "Present Land Use" and "Principal Suitability". The numerals which denote this land use and suitability are: 1. Grazing: 2. Cropland: 3. Recreation: 4. Wildlife: 5. Mining: 6. Watershed: 7. Timber: 8. Human Occupancy and Industrial Development: 9. Access and Preservation of Public Values: 10. Submerged. "PSW" identifies a Power Site Withdrawal; "SDW" a Stock Driveway Withdrawal; "Rec" a Recreation Site Withdrawal; and "PWR" a Public Water Withdrawal.

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp. North	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
1	44	2	Lots 1,2;S½NE¼	162	Gently to mod. rolling range	19	1-4-6	VII	1-4-6	Private
1	44	6	Lots 1,2;S½NE¼;SE¼	321	Mod. rolling range	54	1-6	VI	1	Private
1	44	22	NW¼	160	Mod. rolling, rough range	24	1-6	VII/128:VIII/32	1-3-6	Public
1	44	28	SW¼NW¼;SW¼;W½SE¼; SE¼SE¼	320	Rough,nearly barren, rocky	48	1-4-6	VII	1-3	Public
1	44	32	NE¼;SW¼NW¼;W½SW¼; SE¼SW¼	320	Rough,nearly barren, rocky	55	1-4-6	VI/88:VII/160: VIII/72	1-3	Public
1	44	34	SW¼SW¼;SE¼SE¼	80	Gently to mod. rolling grassland	14	1	VI	1	Private

Custer County

Twp. North	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
1	45	2	Lots 5-11	339.41	Mod. rolling to steep range	60	1-4-6	VII	1-4-6	Public
1	45	4	Lots 5-8;SW¼NE¼	193.90	Mod. rolling to steep range	29	1-4-6	VII	1-3-4-6	Public
1	45	6	SE¼;Lot 1;SE¼NE¼	240.21	Mod. rolling to steep range	27	1-4-6	VII	1-4-6	Private
1	45	10	NE¼NE¼	40	Mod. rolling to steep range	8	1-4-6	VII	1-4-6	Public
1	45	10	NW¼SW¼;SE¼SW¼	80	Gently to strongly rolling grassland	14	1-4-6	VII	1-3-4-6	Public
1	45	12	Lots 1-4	183.55	Strongly rolling grassland	41	1-6	VII	1-6	Private
1	45	14	NW¼NW¼;S½SW¼	120	Mod. rolling to steep range	29	1-4-6	VII	1-4-6	Public
1	45	20	S½;NE¼;N½NW¼;SE¼NW¼	600	Gently rolling to steep	107	1-4-6	VII	1-4-6	Public
1	45	22	N½	320	Gently rolling to steep	76	1-4-6	VII	1-4-6	Public
1	45	24	NE¼NE¼	40	Mod. rolling to steep	6	1-6	VII	1-6	Private
1	45	24	NW¼SW¼;S½SW¼	120	Mod. rolling to steep grassland	21	1-6	VII	1-6	Private
1	45	26	S½	320	Rolling hills with steep breaks	71	1-4-6	VII	1-3-4-6	Public
1	45	28	Lots 1-16	652.74	Mod. rolling to mountainous range	115	1-4-6	VII	1-4-6	Public
1	45	30	All	641.40	Mod. rolling to rough breaks	114	1-4-6	VII	1-4-6	Public
1	45	32	E½W½;E½	480	Mod. rolling to steep range	71	1-4-6	VII	1-4-6	Public
1	45	34	All	640	Nearly level to very steep range	134	1-4-6	VII	1-4-6	Public
1	46	4	Lots 1-4;S½NE¼;E½SE¼	345	Mod. to strongly rolling	71	1-6	VII	1-6	Private
1	46	6	SE¼SE¼;SE¼SW¼	80	Mod. to strongly rolling	16	1-6	VII	1-6	Private
1	46	10	SE¼;E½SW¼;SW¼SW¼; SE¼NW¼	320	Strongly rolling range	38	1-6	VII	1-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Custer County

Twp North	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
1	46	30	Lot 1	49.32	Strongly rolling to hilly	8	1-6	VII	1-6	Private
1	47	2	Lot 3	47	Mod. rolling range	14	1-6	VI	1-6	Private
1	47	4	N½	344	Mod. rolling range	47	1-4-6	VI/176:VII/168	1-4-6	Public
1	47	6	SE¼SE¼	40	Gently to strongly rolling	5	1-4-6	VII	1-4-6	Public
1	47	8	N½N½;S½NE¼	240	Gently to strongly rolling	47	1-4-6	VI/170:VII/70	1-4-6	Public
1	47	8	S½SE¼	80	Steep rolling range	13	1-4-6	VI	1-4-6-7	Private
1	47	14	E½NW¼;NE¼;E½SE¼	320	Strongly rolling to breaks	54	1-4-6	VII	1-4-6	Public
1	47	28	NW¼;N½SW¼;W½NE¼	320	Gently to strongly rolling	50	1-4-6	VII	1-4-6	Public
1	48	2	N½S½;S½N½	320	Gently to mod. rolling	57	1-4-6	VII	1-4-6-7	Public
1	49	2	All	700	Strongly rolling grassland	132	1-4-6	VII	1-3-4-6	Public
1	49	10	NE¼	160	Strongly rolling grassland	30	1-4-6	VII	1-3-4-6	Public
1	49	10	W½NW¼;NW¼SW¼	120	Strongly rolling grassland	23	1-4-6	VII	1-3-4-6	Public
1	49	14	N½NE¼;S½S½;NW¼SW¼	280	Gently to strongly rolling	45	1-4-6	VI/35:VII/245	1-4-6	Private
1	49	22	N½NE¼	80	Gently to strongly rolling	12	1-4-6	VI/27:VII/53	1-4-6	Private
Rosebud County										
2	44	22	NE¼NW¼;NW¼NE¼	80	Gently rolling range	11	1-4-6	VI	1-4-6	Private
2	44	26	NW¼;W½NE¼	240	Gently rolling range	24	1-4-6	VI	1-4-6	Private
2	44	34	E½	320	Mod. rolling range	32	1-4-6	VII	1-4-6	Private
Custer County										
2	45	4	Lots 5-20	644.18	Mod. rolling to hilly	91	1-6	VII	1-6	Private
2	45	8	S½	320	Mod. rolling grassland	32	1-6	VII	1-6	Private
2	45	10	Lot 3	13.64	Nearly level cropland	1	1-2	II	1-2	Private
2	45	12	SW¼	149.51	Mod. rolling to very steep	17	1-4-6	VII/89:VIII/61	1-4-6	Private
2	45	14	All	640	Gently rolling to very steep	85	1-4-6	VII	1-4-6	Public
2	45	24	All	640	Rough, thin breaks	71	1-4-6	VI/30:VII/574: VIII/36	1-4-6	Public
2	45	26	All	640	Gently rolling to very steep	92	1-4-6	VII	1-4-6	Public
2	45	32	NW¼NE¼;SE¼NE¼;NE¼SE¼; S½S½	280	Mod. to strongly rolling	40	1-4-6	VII	1-4-6	Public
2	45	34	N½;SE¼;E½SW¼	560	Gently rolling to very steep	91	1-4-6	VII	1-4-6	Public
2	46	2	SE¼SW¼	40	Strongly sloping range	3	1-4-6	VII	1-4-6	Public

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Custer County

Twp North	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
2	46	4	SW¼SE¼	40	Mod. rolling grassland	6	1-4-6	VII	1-4-6	Public
2	46	6	Lots 5-7;E½SW¼;SE¼	370.06	Gently to mod. rolling	35	1-4-6	VI/129:VII/242	1-4-6-9	Public
2	46	8	All	640	Gently rolling to very steep	87	1-4-6	VI/530:VII/110	1-4-6-9	Public
2	46	10	All	640	Mod. rolling range	90	1-4-6	VII	1-4-6	Public
2	46	12	All	640	Gently to mod. rolling	106	1-4-6	VI/235:VII/405	1-4-6	Public
2	46	14	S½S½;NE¼SE¼!E½NE¼; NW¼NE¼	320	Mod. rolling range	51	1-4-6	VII	1-4-6	Public
2	46	18	Lots 1-4;E½NW¼;W½NE¼	337.88	Gently to mod. rolling	46	1-4-6	VI/209:VII/129	1-4-6	Public
2	46	20	All	640	Gently rolling to steep	58	1-4-6	VII	1-4-6	Public
2	46	24	All	640	Mod. rolling range	118	1-4-6	VII	1-4-6	Public
2	46	30	Lots 1-4;E½;E½W½	658	Mod. rolling to rough breaks	71	1-4-6	VII	1-4-6-9	Public
2	47	4	Lot 1	42.42	Gently rolling range	9	1-4-6	VI	1-4-6	Private
2	47	6	Lots 3-4;SW¼NE¼	126.12	Gently rolling range	18	1-4-6	VI/40:VII/86	1-3-4-6-9	Public
2	47	8	E½NE¼	80	Gently rolling range	16	1-6	VI	1-6	Private
2	47	22	S½	320	Mod. rolling grassland	64	1-6	VII	1-6	Private
2	48	4	Lot 4	43.34	Gently rolling range	9	1-6	VI	1-6	Private
2	48	6	SE¼SE¼	40	Strongly rolling range	3	1-4-6	VII	1-4-6	Private
2	48	12	E½	320	Steep sloping range	51	1-4-6	VII	1-4-6	Public
2	48	24	SW¼NW¼	40	Mod. sloping range	5	1-4-6	VII	1-4-6	Private
2	48	34	S½SE¼	80	Mod. rolling range	11	1-4-6	VII	1-4-6	Private
2	49	2	Lots 5-20	641.20	Strongly rolling grassland	64	1-4-6	VII	1-4-6	Public
2	49	8	S½	320	Strongly sloping range	39	1-4-6	VII	1-3-4-6-7	Public
2	49	14	Lots 1-16	761.61	Steep grassland range	85	1-4-6	VII	1-4-6	Public
2	49	22	Lots 1-16	666.02	Gently rolling range	80	1-4-6	VII	1-4-6	Public
2	49	26	All	640	Steep grassland range	77	1-4-6	VII	1-4-6	Public
2	50	6	Lots 1-5;SE¼NW¼;S½NE¼	268.82	Mod. rolling grassland	32	1-4-6	VII	1-4-6	Public

Rosebud County

Twp North	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
3	44	2	E½E½	160	Mod. rolling grassland	33	1-4-6	VII	1-4-6	Private
3	44	12	All	640	Gently rolling to very steep	97	1-4-6	VII	1-4-6	Public
3	44	24	N½N½	160	Mod. rolling to very steep	24	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Custer County

Twp North	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
3	45	4	Lot 2;SW¼NE¼;SE¼NW¼	119.13	Mod. rolling grassland range	22	1-4-6	VII	1-4-6	Private
3	45	6	Lots 1-7;SE¼NW¼;S½NE¼; E½SW¼;SE¼	639.48	Mod. rolling grassland range	114	1-4-6	VII	1-3-4-6	Public
3	45	8	All	640	Mod. rolling grassland range	114	1-4-6	VII	1-3-4-6	Public
3	45	10	W½SW¼;SE¼SW¼;SW¼NW¼	160	Gently rolling to steep	27	1-4-6	VII	1-4-6	Private
3	45	14	S½	320	Gently rolling to steep	50	1-4-6	VII	1-4-6	Private
3	45	18	Lots 1-2;E½NW¼;NE¼	320.89	Mod. sloping range	57	1-4-6	VII	1-3-4-6	Public
3	45	22	All	640	Mod. sloping range	96	1-4-6	VII	1-4-6	Private
3	45	26	All	640	Mod. sloping range	83	1-4-6	VII	1-4-6	Private
3	45	34	All	640	Mod. rolling grassland	96	1-4-6	VII	1-4-6	Private
3	46	4	Lots 1-12;S½N½	660.87	Gently to strongly rolling	54	1-4-6	VII	1-4-6	Private
3	46	10	Lots 2-7;NE¼	376.24	Gently rolling grassland	58	1-4-6	VII	1-3-4-6-9	Public
3	46	18	Lots 1-2;E½NW¼;NE¼; N½SE¼;SE¼SE¼	431.98	Gently to mod. rolling	54	1-4-6	VII	1-4-6	Private
3	46	26	All	640	Mod. sloping range	91	1-4-6	VII/593:VIII/47	1-4-6	Public
3	46	28	S½S½	160	Gently to mod. rolling	23	1-4-6	IV/10:VI/134: VII/16	1-4-6	Public
3	46	32	All	640	Mod. rolling grassland	86	1-4-6	VII	1-4-6-9	Public
3	46	34	All	640	Gently rolling to very steep breaks	70	1-4-6	VI/167:VII/357: VIII/116	1-4-6	Public
3	47	2	Lots 1-4;S½N½;W½SW¼; N½SE¼	473.67	Gently rolling to steep	82	1-4-6	VI/384:VII/90	1-4-6	Public
3	47	10	W½SW¼	80	Mod. rolling grassland	9	1-6	VII	1-6	Private
3	47	10	E½NE¼;NE¼SE¼	120	Gently to strongly rolling	12	1-4-6	VI/50:VII/70	1-4-6	Public
3	47	14	NE¼;NE¼SE¼	200	Steep sloping range	10	1-4-6	VII	1-4-6	Public
3	47	14	W½SW¼;SE¼SW¼	120	Gently rolling to steep	10	1-4-6	VI/50:VII/70	1-3-4-6	Public
3	47	18	N½NE¼	80	Mod. rolling grassland	10	1-6	VII	1-6	Private
3	47	22	All	640	Gently rolling to steep	77	1-4-6	VI/381:VII/259	1-4-6	Public
3	47	26	E½	320	Mod. rolling range	35	1-4-6	VI/63:VII/257	1-4-6	Public
3	47	30	NE¼;NE¼NW¼	200	Gently rolling grassland	42	1-4-6	VI	1-4-6	Private
3	48	4	Lots 1-4;S½N½;S½	640.88	Gently to mod. sloping range	108	1-4-6	VI/202:VII/439	1-4-6	Public
3	48	6	Lots 1-7;SE¼NW¼;S½NE¼; E½SW¼;SE¼	634.11	Gently to strongly sloping	72	1-4-6	VII	1-4-6	Public
3	48	10	All	640	Nearly level to mod. rolling	93	1-4-6	VI/193:VII/447	1-4-6	Public
3	48	30	Lots 1-4;E½W½;E½	640.88	Gently to mod. sloping	102	1-4-6	VII	1-4-6	Public
3	49	12	Lots 1-2	87.40	Strongly rolling range	10	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Custer County

Twp North	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
3	50	6	Lots 1-2 & 7;SE¼NW¼; SE¼;S½NE¼;E½SW¼	487.07	Gently rolling to steep	72	1-4-6	VII	1-4-6	Private
3	50	20	All	640	Mod. sloping to steep breaks	94	1-4-6	VI/142:VII/498	1-4-6	Public
4	45	14	W½	320	Mod. sloping range	74	1-4-6	VII	1-3-4-6-9	Public
4	45	24	W½	320	Gently to stronly sloping	43	1-4-6	VII	1-4-6	Private
4	45	32	All	640	Gently to mod. rolling	113	1-4-6	VII	1-3-4-6	Public
4	46	20	SW¼	160	Mod. rolling range	27	1-4-6	VII	1-4-6	Private
4	46	28	S½	320	Gently to mod. rolling	43	1-4-6	VII	1-4-6	Private
4	46	34	N½NW¼;SW¼;W½SE¼	320	Gently to strongly rolling	36	1-4-6	VII	1-4-6	Private
4	47	6	All	624.93	Gently rolling to steep	60	1-4-6	VII	1-4-6	Private
4	47	8	SE¼NE¼;NE¼SE¼;N½NW¼; NW¼NE¼	200	Gently to mod. rolling	27	1-4-6	VII	1-4-6	Private
4	47	10	N½NW¼;NE¼SE¼	120	Gently to strongly rolling	16	1-4-6	VII	1-4-6	Private
4	47	12	SE¼SE¼	40	Nearly level to steeply rolling	5	1-2	IV/10:VII/30	1-2-9	Private
4	47	18	All	617.72	Gently to mod. rolling	102	1-4-9	VII	1-4-9	Public
4	47	22	N½NE¼;SE¼NE¼	120	Strongly rolling range	17	1-4-6	VII	1-4-6	Public
4	47	24	All	640	Gently to strongly rolling	105	1-4-6	VII	1-3-4-6	Public
4	47	34	E½E½	160	Gently to mod. rolling	22	1-4-6	VI/40:VII/120	1-3-4-6	Public
4	48	30	All	626.90	Gently to strongly rolling	90	1-4-6	VI/147:VII/480	1-4-6	Public
4	48	32	All	640	Gently to mod. rolling	105	1-4-6	VI/85:VII/555	1-4-6	Public
4	49	12	S½	320	Mod. rolling grassland	49	1-4-6	VII	1-3-4-6	Public
4	49	26	SW¼SE¼	40	Gently rolling grassland	8	1-4-6	VI	1-4-6	Private
4	50	18	Lot 4; SE¼SW¼	94.35	Mod. to strongly rolling range	18	1-4-6	VII	1-3-4-6-9	Public
5	46	24	E½	320	Gently to strongly rolling range	56	1-4-6	VI/229:VII/91	1-4-6	Public
5	47	2	Lots 1-4;S½N½	316.52	Gently rolling grassland	52	1-4-6	VII	1-4-6	Private
5	47	4	All	640.08	Gently to strongly rolling range	60	1-4-6	VII	1-4-6	Public
5	47	8	All	640	Mod. rolling grassland and rough breaks	60	1-4-6	VII/583:VIII/57	1-4-6	Public
5										
5	47	18	All	602.28	Gently to strongly rolling to badlands	47	1-4-6	VI/33:VII/522: VII/47	1-4-6	Public
5	47	28	SW¼;W½NW¼;S½;SE¼	320	Gently to mod. rolling	42	1-4-6	VI/246:VII/74	1-4-6	Public
5	47	29	All	640	Gently to mod. rolling	76	1-4-6	VI/197:VII/443	1-4-6	Public
5	47	32	N½;SW¼	480	Gently to mod. rolling	74	1-4-6	VII	1-4-6	Public
5	49	22	NW¼NW¼	40	Nearly level to gently rolling	6	1-6	VI	1-6	Private
6	48	26	N½NW¼;SW¼NW¼;NE¼;SE¼SE¼	320	Gently to strongly rolling	26	1-6	VI/ 40:VII/280	1-6	Private
6	48	34	W½SW¼	80	Gently to strongly rolling	6	1-6	VI/38:VII/42	1-6	Private
7	50	30	Lots 1-2;NE¼NW¼;N½NE¼; SE¼NE¼;E½SE¼	314.75	Mod. rolling to very steep	95	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

6th PRINCIPAL MERIDIAN, WYOMING

Sheridan County

Twp North	Range West	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
53	82	18	NE¼SE¼	40	Steep sloping range	14	1-4-6	VII	1-4-5-6	Private
54	85	27	NW¼NE¼ (SDW)	40	Mod. sloping grassland	14	1-9	VII	1-9	Public
54	85	27	W½W½;SE¼SW¼;S½SE¼	280	Strong sloping to rough and mountainous	25	1-3-4-6	VII/62:VIII/218	1-3-4-6	Public
55	81	1	SW¼SE¼	40	Mod. rolling grassland	14	1-6	VI	1-6	Private
55	81	8	NW¼SW¼	40	Steeply rolling browse-shrub	5	1-6	VII	1-6	Private
55	81	9	NE¼SW¼;N½SE¼	120	Steep sloping grassland	20	1-6	VII	1-6	Private
55	81	10	SE¼NW¼;NE¼SW¼;NW¼SE¼	120	Steep sloping grassland	19	1-6	VII	1-6	Private
55	81	11	SW¼NW¼;NW¼SW¼	80	Mod. to steep sloping	14	1-6	VII	1-6	Private
55	81	15	SE¼NW¼	40	Strongly rolling grassland	11	1-6	VII	1-6	Private
55	81	26	Lots 1-5	199.93	Mod. rolling grassland	36	1-6	VI	1-6	Private
55	82	35	NE¼NW¼	40	Strong to steep sloping	8	1-6	VII	1-6	Private
55	83	4	Lot 3	39.55	Strongly sloping;sagebrush	6	1-6	VII	1-6	Private
55	85	13	NE¼SW¼	40	Mod. sloping grassland	10	1-6	VI	1-6	Private
55	86	23	SE¼NE¼	40	Mod. sloping grassland	10	1-6	VI	1-6	Private
55	86	27	SW¼	160	Rough and mountainous	8	3-4-6	VIII	3-4-6	Public
55	86	34	N½N½;SE¼NE¼;SE¼NW¼; NE¼SW¼	280	Rough and mountainous	16	3-4-6	VII/40:VIII/240	3-4-6	Public
56	79	2	Lots 5,7,10-12,14,15	294.84	Strongly rolling;sagebrush	45	1-6	VII	1-6	Private
56	79	4	Lots 5-16;N½SW¼	468.08	Strongly sloping;sagebrush	80	1-6	VII	1-6	Private
56	79	5	NW¼SE¼	40	Mod. to strong sloping	8	1-6	VII	1-6	Private
56	79	6	Lots 8,9	106.79	Strongly sloping; sagebrush	26	1-6	VII	1-6	Private
56	80	31	Lot 6	43.54	Strongly sloping range	9	1-6	VI	1-5-6	Private
56	81	20	NW¼SE¼	40	Steep sloping range	6	1-6	VII	1-5-6	Private
56	81	23	NE¼NW¼	40	Strong sloping range	12	1-6	VI	1-6	Private
56	81	27	SW¼SW¼	40	Strong sloping range	6	1-6	VII	1-6	Private
56	81	31	Lot 2	37.47	Strong sloping range	6	1-6	VII	1-5-6	Private
56	81	31	SE¼NE¼	40	Steep sloping grassland	6	1-6	VII	1-6	Private
56	82	11	SW¼SE¼	40	Mod. sloping grassland	10	1-6	VI	1-6	Private
56	82	27	NW¼SE¼	40	Strong sloping grassland	8	1-6	VII	1-5-6	Private
56	82	27	SW¼NW¼	40	Strong sloping grassland	8	1-6	VII	1-5-6	Private
56	82	28	E½NE¼;NE¼SE¼	120	Strong sloping grassland	24	1-6	VII	1-6	Private
56	82	31	SE¼NE¼;E½SE¼	120	Mod. to strongly rolling	24	1-6	VI	1-6	Private
56	83	12	W½E½	160	Gentle to steep sloping	28	1-4-6	V/5:VI/42:VII/113	1-4-5-6	Public
56	85	8	N½NE¼	80	Strongly rolling range	19	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

6th PRINCIPAL MERIDIAN, WYOMING

Sheridan County

Twp North	Range West	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
56	87	5	Lots 5-7,9-11	60.87	Steep sloping grass-conifer	11	1-6	VII/34:VIII/27	1-6	Private
56	87	23	S½S½	160	Rough and mountainous	16	4-6	VII	3-4-6	Public
56	87	25	S½SW¼	80	Rough and mountainous	8	4-6	VII	3-4-6	Public
56	87	36	All	640	Rough and mountainous	0	4-6	VIII	3-4-6-7	Public
57	78	3	Lot 3	39.12	Mod. rolling range	10	1-6	VI	1-6	Private
57	78	4	SE¼NE¼	40	Mod. rolling range	8	1-6	VI	1-6	Private
57	78	5	SE¼NW¼	40	Mod. rolling range	8	1-6	VI	1-6	Private
57	78	5	NW¼SW¼	40	Mod. rolling range	8	1-6	VI	1-6	Private
57	78	7	SE¼NE¼	40	Mod. rolling range	6	1-6	VII	1-6	Private
57	79	5	SE¼NE¼	40	Mod. rolling grassland	6	1-6	VI	1-6	Private
57	79	5	NW¼SW¼	40	Mod. rolling grassland	6	1-6	VI	1-6	Private
57	79	6	Lot 1	40.33	Mod. rolling grassland	6	1-6	VI	1-6	Private
57	79	7	NW¼NE¼	40	Mod. rolling grassland	5	1-6	VI	1-6	Private
57	79	7	SE¼NE¼	40	Mod. rolling grassland	5	1-6	VI	1-6	Private
57	79	8	SW¼;SE¼NW¼	200	Mod. rolling grassland	40	1-6	VI	1-6	Private
57	79	11	SE¼NW¼	40	Mod. rolling grassland	6	1-6	VII	1-6	Private
57	79	18	NE¼SE¼	40	Strong sloping;sagebrush	6	1-6	VII	1-6	Private
57	79	18	Lots 3-4;SE¼SW¼	116.88	Strongly rolling grassland	15	1-6	VII	1-6	Private
57	79	19	Lot 1;NE¼NW¼;NW¼NE¼	118.78	Strongly rolling grassland	18	1-6	VII	1-6	Private
57	79	22	SE¼NW¼	40	Strongly rolling grassland	6	1-6	VII	1-6	Private
57	79	26	W½NW¼	80	Mod. rolling grassland	14	1-6	VII	1-6	Private
57	79	27	SW¼SW¼	40	Mod. rolling grassland	7	1-6	VII	1-6	Private
57	79	27	SE¼SE¼	40	Mod. rolling grassland	7	1-6	VII	1-6	Private
57	79	27	SW¼NE¼;NW¼SE¼	80	Mod. rolling grassland	14	1-6	VII	1-6	Private
57	79	28	SW¼;S½SE¼;NW¼SE¼	280	Mod. rolling grassland	42	1-6	VII	1-6	Private
57	79	30	S½SE¼	80	Strongly rolling grassland	12	1-6	VII	1-6	Private
57	79	30	NE¼SW¼	40	Strongly rolling grassland	6	1-6	VII	1-6	Private
57	79	30	Lot 4	39.44	Strongly rolling grassland	6	1-6	VII	1-6	Private
57	79	31	Lots 1-4;E½;SE¼NW¼; E½SW¼	598.96	Strongly rolling grassland	85	1-6	VII	1-6	Private
57	79	33	W½NE¼	480	Mod. rolling grassland	72	1-6	VII	1-6	Private
57	79	34	N½NW¼;SW¼NW¼	120	Mod. rolling grassland	17	1-6	VII	1-6	Private
57	79	34	SE¼SE¼	40	Mod. rolling grassland	6	1-6	VII	1-6	Private
57	79	35	S½SW¼	80	Mod. rolling grassland	12	1-6	VII	1-6	Private
57	79	35	NE¼SE¼	40	Mod. rolling grassland	6	1-6	VII	1-6	Private
57	80	3	Lot 2	39.46	Strongly sloping grassland	7	1-6	VII	1-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

6th PRINCIPAL MERIDIAN, WYOMING

Sheridan County

Twp North	Range West	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
57	80	11	N½NE¼;SE¼NE¼	120	Mod. to strongly rolling	22	1-6	VI	1-6	Private
57	80	12	N½;SE¼	480	Mod. rolling range	86	1-6	VI	1-6	Private
57	80	25	S½NW¼;SW¼NE¼	120	Mod. rolling range	24	1-6	VII	1-6	Private
57	81	29	W½NW¼	80	Mod. rolling grassland	12	1-6	VI	1-6	Private
57	81	32	NW¼SW¼	40	Mod. rolling grassland	6	1-6	VI	1-6	Private
57	82	7	SW¼SE¼	40	Mod. rolling grassland	7	1-6	VI	1-6	Private
57	82	20	W½SE¼	80	Strongly rolling range	12	1-6	VII	1-5-6	Private
57	82	30	S½NE¼	80	Strongly rolling range	14	1-6	VII	1-5-6	Private
57	83	10	SE¼NE¼	40	Mod. sloping range	8	1-6	VI	1-5-6	Private
57	83	13	SW¼SW¼	40	Very steep sloping range	2	4-6	VIII	1-4-5-6	Private
57	83	14	SE¼SE¼	40	Very steep sloping range	2	4-6	VIII	1-4-5-6	Private
57	83	24	NW¼NW¼	40	Very steep sloping range	2	4-6	VIII	1-4-5-6	Private
57	83	33	SW¼NW¼	40	Mod. sloping range	10	1-6	VI	1-6	Private
57	84	5	Lot 3	40.16	Mod. sloping range	8	1-6	VI	1-6	Private
57	84	5	SE¼SW¼;SW¼SE¼	80	Mod. rolling range	16	1-6	VI	1-6	Private
57	84	6	Lot 5	40.01	Strongly sloping range	8	1-6	VII	1-6	Private
57	84	7	Lots 2-4;E½SW¼;W½SE¼; SE¼NW¼;SW¼NE¼	359.05	Mod. rolling range	104	1-6	VI/239:VII/120	1-6	Public
57	84	9	SE¼NW¼	40	Mod. sloping range	8	1-6	VI	1-6	Private
57	87	19	NW¼NW¼ (SDW)	40	Steep sloping foothills	9	1-4-6-9	VII	1-4-6-9	Public
57	87	19	Lot 1 (SDW)	38.48	Steep sloping;browse-shrub	9	1-6-9	VII/29:VIII/9	1-6-9	Public
57	87	19	Lots 3,4;E½SW¼;SE¼(SDW)	317.59	Rough and mountainous	48	1-4-6-9	VII	1-4-6-9	Public
57	87	20	S½SW¼ (SDW)	80	Rough and mountainous	12	1-4-6-9	VI	1-4-6-9	Public
57	87	29	SW¼ (SDW)	160	Rough and mountainous	10	4-6-9	VIII	4-6-9	Public
58	78	23	Lots 1,2	37.32	Strong sloping range	5	1-6	VII	1-6	Private
58	78	26	NE¼SE¼	40	Mod. sloping range	8	1-6	VI	1-6	Private
58	78	27	NE¼NE¼	40	Mod. sloping range	8	1-6	VI	1-6	Private
58	78	30	Lot 1	37.16	Mod. sloping range	7	1-6	VI	1-6	Private
58	78	31	SW¼NE¼	40	Mod. sloping range	8	1-6	VI	1-6	Private
58	78	33	N½SW¼;SE¼SW¼;NW¼SE¼; S½SE¼	240	Mod. sloping range	40	1-6	VI	1-6	Private
58	78	34	S½SW¼	80	Mod. sloping range	14	1-6	VI	1-6	Private
58	79	17	Lot 1	16.94	Mod. sloping range	5	1-6	VII	1-6	Private
58	79	18	Lot 2	37.36	Mod. sloping range	6	1-6	VII	1-6	Private
58	79	19	Lot 4	38.29	Mod. sloping range	7	1-6	VI	1-6	Private
58	79	19	E½NE¼	80	Mod. sloping range	12	1-6	VII	1-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming

6th PRINCIPAL MERIDIAN, WYOMING

Sheridan County

Twp North	Range West	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
58	79	20	E½NE¼	80	Mod. sloping range	13	1-6	VI	1-6	Private
58	79	25	SE¼	160	Mod. sloping range	35	1-6	VI	1-6	Private
58	79	31	Lot 1	37.75	Mod. sloping range	8	1-6	VII	1-6	Private
58	79	31	Lot 4	36.93	Mod. sloping range	7	1-6	VII	1-6	Private
58	79	31	E½SE¼	80	Mod. sloping range	16	1-6	VII	1-6	Private
58	79	34	NE¼SW¼	40	Mod. sloping range	7	1-6	VI	1-6	Private
58	80	13	Lots 1,2	63.92	Mod. sloping range	14	1-6	VI	1-6	Private
58	80	14	Lot 1	36.58	Mod. sloping range	9	1-6	VII	1-6	Private
58	82	21	SE¼NE¼	40	Mod. rolling grassland	9	1-6	VI	1-6	Private
58	82	26	S½NE¼;S½SE¼	160	Strongly rolling grassland	24	1-6	VII	1-6	Private
58	82	27	N½NE¼;NE¼NW¼	120	Strongly rolling grassland	18	1-6	VII	1-6	Private
58	82	27	Lot 2;SE¼NW¼	71.16	Mod. rolling grassland	16	1-6	VI	1-6	Private
58	83	24	Lot 2;SW¼NE¼	71.38	Mod. rolling range	18	1-6	VI	1-6	Private
58	83	25	N½NW¼;W½SE¼;S½SW¼	240	Mod. rolling range	47	1-6	VI	1-6	Private
58	84	17	Lot 1	30.72	Strong sloping range	6	1-6	VII	1-6	Private
58	84	18	Lot 1	42.97	Strong sloping range	8	1-6	VII	1-6	Private
58	84	20	N½NE¼	80	Strongly rolling range	16	1-6	VII	1-6	Private
58	84	21	NW¼NW¼	40	Strong sloping range	8	1-6	VII	1-6	Private
58	85	22	SW¼NE¼	40	Mod. to strong sloping grassland	8	1-6	VI	1-6	Private
58	85	26	S½SW¼	80	Strongly rolling range	16	1-6	VI	1-6	Private
58	85	27	S½SE¼	80	Strongly rolling range	16	1-6	VI	1-6	Private
58	85	29	SE¼NE¼	40	Mod. to strong sloping	8	1-6	VI	1-6	Private
58	86	13	Lots 1,2	62.79	Strongly rolling range	5	1-6	VII	1-5-6	Private
58	86	14	Lot 4	37.16	Steep sloping range	6	1-6	VII	1-6	Private
58	86	15	Lot 1	38.15	Steep sloping range	3	1-4-6	VIII	1-4-5-6	Private
58	86	22	NE¼NE¼;SE¼	200	Strong sloping range	24	1-6	VII	1-5-6	Private
58	86	23	W½SW¼	80	Strongly rolling range	8	1-6	VII	1-6	Private
58	86	26	W½SW¼	80	Strongly rolling range	8	1-6	VII	1-6	Private
58	86	27	SW¼NE¼;NW¼SE¼	80	Strongly rolling range	8	1-6	VII	1-6	Private
58	86	34	SW¼SW¼	40	Strongly rolling range	4	1-6	VII	1-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
1	43	32	E½	320	Mod. to steep range	74	1-6	VI	1-6	Private
1	43	34	E½	320	Mod. to steep range and woodland	76	1-4-6	VI	1-4-6	Private
1	44	2	Lot 9	18.76	Nearly level;adjacent to river	2	1-4	VI	1-4	Private
1	44	10	Lot 1	6.29	Nearly level;adjacent to river	1	1-4	VI	1-4	Private
1	44	12	NW¼NW¼	40	Gentle sloping range	6	1-6	VI	1-6	Private
1	44	12	NE¼;SE¼NW¼	200	Steep range	26	1-6	VII	1-6	Private
1	44	14	Lot 2	5.16	Nearly level;adjacent to river	0	1-4	VI	1-4	Private
1	44	22	Lot 3	14.12	Nearly level;adjacent to river	2	1-4	V	1-3-4	Public
1	44	28	Lot 1	0.28	Nearly level;adjacent to river	0	1-4	0	1-4	Private
1	44	34	Lot 4	18.14	Nearly level;adjacent to river	1	1-4	VI	1-4	Public

Powder River County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
1	45	2	Lot 1	45.40	Very steep sloping range	5	1-6	VI	1-6	Private
1	45	10	SW¼SE¼	40	Gentle sloping range	11	1-6	VI	1-6	Private
1	45	12	SE¼SE¼	40	Gentle sloping range	8	1-6	VI	1-6	Private
1	45	22	NW¼NE¼	40	Mod. sloping range	10	1-6	VI	1-6	Private
1	47	2	Lot 1	47.13	Mod. sloping range	8	1-6	VI	1-5-6	Private
1	47	4	Lot 4	48.33	Mod. sloping range	13	1-6	VII	1-6	Private
1	48	4	SE¼SE¼	40	Gentle sloping range	9	1-6	VII	1-6	Private
1	48	8	NW¼NE¼	40	Gentle sloping range	4	1-6	VI	1-6	Private

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
2	44	10	Lot 4	27.40	Nearly level;adjacent to river	12	1-4	V	1-3-4	Public
2	44	26	N½SE¼	80	Steep sloping range and woodland	12	1-4-6	VI	1-4-6	Private
2	44	34	Lot 6	8.48	Nearly level;adjacent to river	2	1-4-6	III	1-3-4-6	Public

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Rosebud County										
2	44	34	Lots 4,5	60.83	Abandoned cropland	0	2	III	3	Public
Powder River County										
2	45	6	Lots 1,8-10;$SE\frac{1}{4}$	317	Mod. to strongly rolling	47	1-6	VI/87:VII/230	1-4-6	Public
2	47	2	Lot 1	41.48	Gentle sloping range	7	1-6	VI	1-6	Private
2	48	4	Lots 2-4;$S\frac{1}{2}NW\frac{1}{4}$;$SW\frac{1}{4}NE\frac{1}{4}$	237.69	Gently rolling grassland	57	1-6	VI	1-6	Public
2	48	14	$W\frac{1}{2}NW\frac{1}{4}$	80	Mod. rolling grassland	14	1-6	VI	1-6	Public
Rosebud County										
3	44	2	Lots 5,11	80.54	Steep range and woodland	12	1-4-6	VII	1-4-6	Private
3	44	3	Lots 18,21,23	47.92	Nearly level;adjacent to river	24	1-4-6	IV/39:VI/9	1-3-4-6	Public
3	44	15	Lot 9	2.36	Nearly level cropland	1	2-4-6	III	2	Private
3	44	22	Lot 6	17.39	Nearly level cropland	2	1-2-4	VI	1-2-3-4	Public
3	44	24	$S\frac{1}{2}N\frac{1}{2}$	160	Gentle sloping range and woodland	20	1-4-6	VI	1-4-6	Private
3	44	28	Lot 1	2.93	Nearly level;adjacent to river	1	1-4-6	I	1-4-6	Private
3	44	34	All	640	Nearly level to steep	113	1-4-6	VI	1-4-6	Private
Powder River County										
3	48	12	$NE\frac{1}{4}NE\frac{1}{4}$	40	Mod. rolling grassland	10	1-6	VII	1-6	Private
3	48	32	$SE\frac{1}{4}SW\frac{1}{4}$;$S\frac{1}{2}SE\frac{1}{4}$	120	Gently rolling grassland	24	1-6	VI	1-6	Public
3	48	34	All	640	Gently to mod. rolling	123	1-4-6	VI	1-4-6	Public
3	49	9	$NE\frac{1}{4}NW\frac{1}{4}$	40	Gentle sloping range	11	1-6	VI	1-6	Private
3	49	20	$N\frac{1}{2}$;$N\frac{1}{2}SE\frac{1}{4}$	400	Gently rolling grassland	108	1-6	VI	1-6	Private
Rosebud County										
4	43	23	Lot 3	5.15	Nearly level;adjacent to river	2	1-4-6	VI	1-4-6	Private
4	43	26	Lot 6	6.70	Nearly level;adjacent to river	0	1-4	VI	1-4	Private
4	43	26	Lot 7	4.04	Nearly level;adjacent to river	0	1-4	VI	1-4	Private
4	43	34	Lot 5;$SE\frac{1}{4}SE\frac{1}{4}$	80.18	Mod. to steep range	11	1-6	VI	1-6	Public

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
4	44	8	Lot 5	4.85	Nearly level along Tongue River	1	1-4	VI	1-3-4	Public
4	44	20	All	640	Gentle sloping range and woodland	96	1-4-6	VI	1-4-6	Public
4	44	32	All	563.04	Gentle to steep sloping	95	1-4-6	VI/212:VII/351	1-4-6	Public

Powder River County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
4	45	4	Lots 1,2	71.27	Mod. sloping range	9	1-6	VI	1-6	Private
4	45	6	All	615.89	Gentle sloping range	104	1-4-6	VI/152:VII/464	1-4-6	Public
4	45	10	NE¼SE¼	40	Mod. sloping range	8	1-6	VI	1-6	Private
4	45	14	E½	320	Mod. rolling grassland	32	1-4-6	VI	1-3-4-6	Public
4	45	20	N½NE¼;NE¼NW¼;Lot 1	147.37	Nearly level to mod. sloping	32	1-6	VII	1-6	Public
4	45	24	Lots 2,3,6,7;E½W½	319.66	Steeply rolling woodland	58	1-4-6	VI/180:VII/140	1-3-4-6	Public
4	48	2	All	640	Gently to mod. rolling	102	1-4-6	VI/290:VII/350	1-4-6	Public
4	48	4	All	640	Mod. rolling grassland	83	1-4-6	VI	1-4-6	Public
4	48	6	Lot 4	36.99	Gentle to mod. sloping	5	1-6	VII	1-6	Private
4	48	6	Lot 7	37.39	Gentle sloping range	7	1-6	VII	1-6	Public
4	48	33	W½NW¼	80	Gently to mod. rolling	13	1-6	VII	1-6	Public

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
5	41	24	E½	320	Gentle to strong sloping	32	1-4-6	VII	1-4-6	Public
5	41	25	All	640	Gentle to strong sloping	71	1-4-6	VII	1-4-6	Public
5	41	30	All	637.44	Gentle to steep sloping	128	1-4-6	VI	1-4-6	Private
5	41	31	NW¼NE¼	40	Gentle to steep sloping	7	1-4-6	VI	1-4-6	Private
5	41	31	Lot 4	39.95	Gentle to steep sloping range	9	1-6	VI	1-6	Private
5	41	32	S½NE¼;SE¼SE¼	120	Gentle to steep sloping range	16	1-4-6	VI	1-4-6	Private
5	42	19	SW¼;W½SE¼	240	Gentle to strong sloping	24	1-4-6	VII	1-4-6	Public
5	42	20	Lot 4	35.46	Gentle to steep range	5	1-4-6	VII	1-4-6	Private
5	42	28	SW¼	160	Gentle to strong sloping	19	1-4-6	VII	1-4-6	Public
5	42	29	All	640	Gentle to strong sloping	75	1-4-6	VI/495:VII/145	1-4-6	Public
5	42	30	All	640	Gentle to strong sloping	69	1-4-6	VII	1-4-6	Public
5	42	31	All	640	Gentle to strong sloping	74	1-4-6	VII	1-4-6	Public
5	42	32	All	640	Gentle to strong sloping	59	1-4-6	VII	1-4-6	Public
5	42	33	All	640	Gentle to strong sloping	68	1-4-6	VII	1-4-6	Public

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
5	42	34	Lots 2,3	81.88	Gentle to strong sloping	10	1-4-6	VII	1-4-6	Public
5	42	36	Lot 5	2.13	Nearly level river bottom land	0	4-5-8	VII	1-3-4-5-8	Public
5	43	2	All	651.42	Gentle to steep sloping range	79	1-4-6	VI/323:VII/328	1-4-6	Private
5	43	10	Lot 1	44.27	Gentle to steep sloping range	6	1-4-6	VI/28:VII/16	1-4-6	Private
5	43	17	Lot 4	7.11	Nearly level island in river	1	1-4	VI	1-3-4	Public
5	43	18	Lot 5	21	Nearly level;adjacent to river	5	1-4-6	VI	1-3-4-6	Public
5	43	29	Lots 2,3,6,7	48.60	Mod. rolling to steep	4	1-4-6	VI/5:VII/44	1-4-5-6	Public
5	43	30	Lots 3-6	166.33	Mod. rolling to steep	16	1-4-6	VI/46:VII/120	1-4-5-6	Public
5	43	31	Lots 1,8-11;E½SW¼;SE¼; S½NE¼	473.78	Mod. rolling to steep	34	1-4-6	VII	1-4-5-6	Public

Powder River County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
5	45	22	N½NE¼ (PWR)	80	Mod. rolling grassland	28	1-6-9	VI	1-6-9	Public
5	45	23	NW¼NW¼	40	Mod. rolling grassland	14	1-6-9	VI	1-6-9	Public
5	48	5	SE¼SE¼	40	Gentle to mod. sloping range	3	1-6	VII	1-6	Private
5	48	20	NW¼SW¼	40	Mod. sloping range	5	1-6	VII	1-6	Private

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
6	40	1	SE¼NW¼;SW¼NE¼;NW¼SE¼	120	Gently sloping grassland	30	1-4-6	VI	1-4-6	Public
6	40	12	SE¼SW¼;W½SE¼	120	Mod. sloping grassland	30	1-4-6	VI	1-4-6	Public
6	40	13	S½S½	160	Gentle to strongly sloping; sagebrush	37	1-4-6	VI	1-3-4-6	Public
6	40	14	S½NE¼;SE¼	240	Mod. sloping; conifer	60	1-4-6	VI	1-3-4-6	Public
6	40	14	SW¼NW¼	40	Mod. rolling; conifer	8	1-4-6	VII	1-4-6	Private
6	40	15	SW¼SE¼	40	Gently sloping grassland	8	1-4-6	VI	1-4-6	Private
6	40	17	SE¼SE¼	40	Mod. sloping grassland	7	1-6	VII	1-8	Private
6	40	19	NE¼NW¼	40	Strongly sloping grassland	7	1-6	VI	1-8	Private
6	40	24	NE¼NW¼;N½NE¼	120	Gently sloping range	27	1-4-6	VI	1-3-4-6	Public
6	40	25	SW¼SE¼	40	Mod. rolling grassland	7	1-4-6	VI	1-4-6	Public
6	40	28	SW¼NW¼	40	Gently sloping grassland	7	1-4-6	VI	1-8	Private
6	40	33	S½NE¼	80	Gentle to steeply sloping grassland	10	1-4-6	VII	1-4-6	Private
6	40	34	S½NW¼;NE¼NE¼;S½NE¼;SE¼	360	Gentle to steeply sloping grassland	47	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
6	40	35	S½	320	Gentle to steeply sloping grassland	42	1-4-6	VII	1-4-6	Private

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
6	41	1	Lots 1-7;S½NW¼;SW¼NE¼; N½SW¼;E½SW¼;SE¼SW¼	603.72	Gentle to strong sloping	78	1-4-6	VII	1-4-6	Public
6	41	2	Lot 1;SE¼NE¼	78.18	Gentle to mod. sloping	12	1-4-6	VII	1-4-6	Public
6	41	3	S½SE¼	80	Mod. rolling range	17	1-4-6	VII	1-4-6	Public
6	41	4	S½SE¼	80	Gentle rolling to steep	16	1-4-6	VI	1-4-6	Public
6	41	5	S½SE¼;SE¼SW¼	120	Gentle rolling to steep	20	1-4-6	VI/62:VII/58	1-4-6	Public
6	41	6	Lot 2	50.98	Mod. rolling grassland	10	1-6	VI	1-6	Private
6	41	6	Lots 4-6;NE¼SW¼;N½SE¼; SW¼SE¼	318.56	Gently rolling to steep	59	1-4-6	VI/208:VII/110	1-4-6	Public
6	41	7	Lots 3,4;SE¼SW¼	137.06	Mod. rolling grassland	33	1-4-6	VI	1-3-4-6	Public
6	41	8	NE¼;N½SE¼;SE¼SE¼	280	Gently rolling to steep grassland	41	1-4-6	VI/12:VII/268	1-4-6	Public
6	41	9	W½;SE¼;S½NE¼;NW¼NE¼	600	Gently rolling to steep grassland	85	1-4-6	VI/113:VII/487	1-4-6	Public
6	41	10	S½	320	Gently rolling to steep grassland	55	1-4-6	VI/170:VII/150	1-4-6	Public
6	41	11	W½W½;SE¼NW¼;SW¼NE¼	240	Gently rolling to steep grassland	44	1-4-6	VI/150:VII/90	1-4-6	Public
6	41	14	All	640	Gently rolling to steep grassland	91	1-4-6	VI/227:VII/413	1-4-6	Public
6	41	15	All	640	Gently rolling to steep grassland	77	1-4-6	VI/78:VII/562	1-4-6	Public
6	41	17	SE¼NW¼;SW¼	200	Mod. rolling grassland	37	1-4-6	VI/163:VII/37	1-3-4-6	Public
6	41	18	Lots 1-4;E½W½;S½NE¼; SE¼	594.68	Mod. rolling grassland	119	1-4-6	VI/505:VII/90	1-3-4-6	Public
6	41	19	Lot 1;E½NW¼;NE¼	288.76	Mod. rolling grassland	62	1-4-6	VI/283:VII/6	1-3-4-6	Public
6	41	20	NW¼	160	Mod. rolling grassland	33	1-4-6	VI	1-3-4-6	Public
6	41	22	NE¼NE¼	40	Gently rolling to steep	6	1-4-6	VII	1-4-6	Public
6	41	23	W½;NE¼;N½SE¼	560	Gently rolling to steep	72	1-4-6	VII	1-4-6	Public
6	41	24	NE¼SW¼	40	Steep grassland and woodland	4	1-4-6	VII	1-4-6	Private
6	41	26	SE¼SW¼	40	Mod. sloping range	8	1-4-6	VI	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
6	41	27	SW¼SW¼	40	Mod. sloping range	10	1-4-6	VI	1-4-6	Public
6	41	28	SE¼SE¼	40	Mod. sloping range	10	1-4-6	VI	1-4-6	Public
6	41	29	S½SW¼	80	Steep range and woodland	15	1-4-6	VI	1-4-6	Private
6	41	30	E½SE¼	80	Steep range and woodland	15	1-4-6	VI	1-4-6	Private
6	41	30	N½NE¼	80	Steep range and woodland	11	1-4-6	VII	1-4-6	Private
6	41	31	NE¼NE¼	40	Steep range and woodland	18	1-4-6	VII	1-4-6	Private
6	41	31	Lots 2-4;E½SW¼	228.24	Rolling grassland and scrub timber	49	1-4-6	VI	1-4-6	Public
6	41	32	N½NW¼;NW¼NE¼	120	Steep range and woodland	23	1-4-6	VI	1-4-6	Public
6	41	33	NE¼	160	Mod. rolling range	40	1-4-6	VI	1-4-6	Public
6	41	33	S½SE¼	80	Gentle to steep range	18	1-4-6	VI	1-4-6	Public
6	41	35	NE¼NW¼	40	Mod. sloping range	8	1-4-6	VI	1-4-6	Private
6	42	1	Lot 8	39.60	Mod. to steep sloping	4	1-4-6	VII	1-4-6	Public
6	42	2	Lots 2-4;SW¼;S½NW¼; SW¼NE¼;N½SE¼;SW¼SE¼	521.89	Gentle to steep sloping range	55	1-4-6	VII	1-4-6	Public
6	42	3	All	647.48	Gentle to steep sloping range	69	1-4-6	VII	1-4-6	Public
6	42	4	All	642.38	Gentle to steep sloping range	80	1-4-6	VII	1-4-6	Public
6	42	5	Lots 1-4;S½N½;N½S½; SE¼SW¼;S½SE¼	597.16	Gentle to steep sloping range	78	1-4-6	VII	1-4-6	Public
6	42	7	Lot 4;SE¼SW¼	87.70	Gentle to steep sloping range	7	1-4-6	VII	1-4-6	Public
6	42	8	N½NE¼	80	Gentle to strong sloping range	10	1-4-6	VII	1-4-6	Public
6	42	8	SW¼;S½SE¼	240	Gentle to steep sloping range	18	1-4-6	VII	1-4-6	Public
6	42	9	N½N½;S½NE¼;N½SE¼	320	Gentle to strongly sloping range	42	1-4-6	VII	1-4-6	Public
6	42	10	E½;NW¼	480	Gentle to steep sloping range	57	1-4-6	VII	1-4-6	Public
6	42	11	Lots 2-7,9-12	392.35	Gentle to steep sloping range	44	1-4-6	VII	1-4-6	Public
6	42	12	NW¼NW¼	40	Gentle to steep sloping range	5	1-4-6	VII	1-4-6	Public
6	42	17	All	662.94	Gentle to steep sloping range	51	1-4-6	VII	1-4-6	Public
6	42	18	Lots 1-4;SE¼;S½NE¼; SE¼NW¼;NE¼SW¼	502.57	Gentle to steep sloping range	39	1-4-6	VII	1-4-6	Public
6	42	19	NE¼NE¼	40	Gentle to steep sloping range	3	1-4-6	VII	1-4-6	Public
6	42	20	Lots 1,2,4;NE¼	282.48	Gentle to steep sloping range	22	1-4-6	VII	1-4-6	Public
6	42	21	Lots 1-4	164.68	Gentle to steep sloping range	13	1-4-6	VII	1-4-6	Public
6	42	25	Lots 1-4;W½E½	296	Gentle to steep sloping range	17	1-4-6	VII	1-4-6	Private
6	42	29	Lots 1,3,4;W½NE¼	212.47	Gentle to steep sloping range	24	1-4-6	VI/50:VII/163	1-4-6	Private
6	42	30	Lots 3,4	93.38	Mod. to steep range	13	1-4-6	VI	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
6	42	31	Lot 3	34.87	Gentle to steep range	4	1-6	VI	1-4-6	Public
6	42	33	Lots 1-6,11,12	318.33	Steep sloping grassland and woodland	23	1-4-6	VII	1-4-6	Public
6	42	34	Lots 4-7;SE¼;E½SW¼	388.87	Steep sloping grassland and woodland	26	1-4-6	VII/218:VIII/170	1-4-6	Public
6	43	5	All	623.12	Strong sloping range	69	1-4-6	VII	1-4-6	Public
6	43	19	SW¼SE¼	40	Strong sloping range	6	1-4-6	VII	1-4-6	Private
6	43	20	Lot 8	39.46	Gentle to steep sloping range	4	1-4-6	VII	1-4-6	Private
6	43	21	Lots 6,7	45.68	Gentle to steep sloping range	5	1-4-6	VII	1-4-6	Private
6	43	21	Lot 5	2.44	Gentle to steep sloping range	0	1-4-6	VII	1-4-6	Private
6	43	29	Lot 5	39.06	Mod. to steep sloping range	12	1-4-6	VII	1-4-6	Private

Powder River County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
6	48	5	Lot 1	39.50	Gentle sloping range	9	1-6	VI	1-4-6	Private

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
7	39	27	Lots 2,3	80.64	Mod. sloping grassland	12	1-4-6	VII	1-3-4-6	Private
7	39	31	Lots 3,4	65.74	Level to mod. sloping grassland	14	1-4-6	VI	1-4-6	Private
7	39	31	SE¼SE¼	40	Mod. sloping grassland	10	1-4-6	VI	1-4-6	Private
7	39	32	SW¼NW¼	40	Gently rolling grassland	11	1-6	VI	1-6	Private
7	40	2	Lots 1,2,3	114.78	Gentle to steeply sloping grassland	15	1-4-6	VII	1-4-6	Private
7	40	2	E½SW¼;W½SE¼;SE¼SE¼	200	Steeply sloping grassland	26	1-4-6	VII	1-4-6	Private
7	40	3	Lot 4	37.79	Gentle to steeply sloping grassland	5	1-4-6	VII	1-4-6	Private
7	40	12	N½N½	160	Strongly sloping grassland	19	1-4-6	VII	1-4-6	Private
7	40	14	SE¼SW¼	40	Strongly rolling grassland	4	1-4-6	VII	1-4-6	Private
7	40	19	Lot 1	37.51	Mod. rolling grassland	6	1-4-6	VII	1-4-6	Private
7	40	27	NE¼SE¼	40	Mod. rolling grassland	10	1-4-6	VII	1-4-6	Private
7	40	28	SW¼NW¼	40	Mod. rolling grassland	10	1-4-6	VII	1-4-6	Private
7	40	28	NW¼SE¼	40	Mod. rolling grassland	10	1-4-6	VII	1-4-6	Private
7	40	31	Lots 3,4;E½SW¼	145.87	Mod. rolling grassland	22	1-2-5	VI	1-5	Public
7	40	34	SE¼	160	Mod. rolling grassland	29	1-4-6	VII	1-4-6	Private
7	40	35	S½SW¼	80	Mod. to steeply sloping grassland	12	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
* 7½	40	34	Lots 1,2	77.86	Mod. rolling grassland	14	1-4-6	VII	1-4-6	Private
7½	40	35	Lots 1,2,3,4;N½SW¼	238.20	Mod. to steeply sloping grassland	36	1-4-6	VII	1-4-6	Private
7½	41	31	Lot 4	33.18	Strongly rolling grassland	8	1-4-6	VI	1-4-6	Public
7½	41	31	Lot 6	35.55	Mod. rolling grassland	7	1-4-6	VI	1-4-6	Private
7½	41	31	NE¼SE¼	40	Steeply sloping;pinon juniper	5	1-4-6	VII	1-4-6	Private
7½	41	32	NW¼SW¼	40	Steeply sloping;pinon juniper	5	1-4-6	VII	1-4-6	Private
7½	41	33	S½SW¼	80	Strongly sloping;pinon juniper	10	1-4-6	VII	1-3-4-6	Public
7½	41	33	Lot 1;E½SE¼	102.20	Strongly sloping;pinon juniper	12	1-4-6	VII	1-3-4-6	Public
7½	41	34	Lots 3,4;SW¼	210.59	Strongly sloping;pinon juniper	34	1-4-6	VII	1-3-4-6	Public
7½	41	34	Lot 1;NE¼SE¼	70.21	Steeply rolling;pinon juniper	6	1-4-6	VII	1-4-6	Private

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
7	41	2	Lots 5-10;W½SE¼	333.22	Gently rolling to steep breaks	54	1-4-6	VI/277:VII/56	1-4-6	Public
7	41	3	All	564.28	Gently rolling to steep breaks	82	1-4-6	VI/353:VII/211	1-4-6	Public
7	41	4	Lots 1-4;S½NE¼;SE¼NW¼; N½SE¼;SE¼SE¼	322.60	Gently rolling to steep breaks	50	1-4-6	VI/175:VII/148	1-4-6	Public
7	41	5	Lot 3,4;S½NW¼;N½SW¼; SW¼NE¼;NW¼SE¼	281.06	Gently rolling grassland	76	1-4-6	VI	1-4-6	Public
7	41	6	Lots 1-5;S½NE¼;SE¼NW¼	231.35	Gently rolling grassland	51	1-4-6	VI	1-4-6	Public
7	41	7	E½W½;SE¼;E½NE¼;SW¼NE¼	440	Gentle to steep sloping range	68	1-4-6	VI/303:VII/137	1-4-5-6	Public
7	41	8	W½;SW¼NE¼	360	Gentle to steep sloping range	63	1-4-6	VI/298:VII/62	1-4-6	Public
7	41	9	S½N½;S½S½;N½SW¼;NW¼SE¼	440	Mod. to steep sloping range	79	1-4-6	VI/225:VII/215	1-4-6	Public
7	41	11	Lots 1,2;NW¼NE¼;	125.77	Gently rolling to steep breaks	26	1-4-6	VI	1-4-6	Public
7	41	13	Lot 3;SE¼NW¼;N½SE¼; SE¼SE¼	203.10	Mod. to steep sloping range	29	1-4-6	VI	1-4-6	Private
7	41	14	Lot 5	40.29	Mod. rolling grassland	10	1-6	VI	1-6	Public
7	41	14	Lots 2,3	80.80	Mod. rolling to steep sloping	19	1-4-6	VI	1-4-6	Public
7	41	15	S½NE¼;NW¼NE¼;N½SE¼	200	Mod. rolling to steep sloping	31	1-4-6	VI/63:VII/137	1-4-6	Public
7	41	18	All	609.32	Gentle to steep sloping range	82	1-4-6	VI/67:VII/542	1-4-5-6	Public
7	41	21	Lots 1-3;NW¼SE¼	140.62	Steep sloping range	17	1-4-6	VII	1-4-6	Public
7	41	23	Lot 4	40.56	Steep sloping range	6	1-4-6	VII	1-4-6	Public
7	41	24	Lots 3,4;SE¼NW¼;SW¼NE¼	165.24	Steep sloping range	23	1-4-6	VII	1-4-6	Public

* Ranges 40 and 41 east, directly south of township 7 south, lie in township 7½ south. Six sections each 31 through 36.

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, with the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
7	41	25	E½NW¼;E½SW¼;NW¼SW¼	600	Steep sloping range	55	1-4-6	VII	1-4-6	Public
7	41	26	NW¼SE¼	40	Steep sloping range	4	1-4-6	VII	1-4-6	Private
7	41	28	Lot 4	50.53	Steep sloping range	12	1-4-6	VI	1-4-6	Private
7	41	31	Lots 1-4	124.87	Gentle to steep sloping	30	1-4-6	VI	1-4-6	Public
7	41	32	Lot 6	42.15	Very steep sloping range	2	1-4-6	VIII	4-6	Public
7	41	33	NE¼NW¼	40	Steep sloping range	6	1-4-6	VII	1-4-6	Public
7	41	33	SW¼NW¼	40	Steep sloping range	6	1-4-6	VII	1-4-6	Public
7	41	33	Lot 2	37.16	Gentle to steep sloping	3	1-4-6	VII	1-4-6	Public
7	41	34	Lot 10	45.63	Gentle to steep sloping	6	1-4-6	VII/37:VIII/9	1-4-6	Private
7	41	35	SE¼NE¼;N½SE¼;NE¼SW¼	160	Steep sloping range	16	1-4-6	VII	1-4-6	Public
7	42	3	Lots 1-4;NE¼SE¼;S½NW¼; S½NE¼	338.80	Steep sloping range	31	1-4-6	VII/196:VIII/143	1-4-6	Public
7	42	5	Lot 12	37.50	Mod. rolling grassland	7	1-6	VI	1-6	Private
7	42	6	NE¼SE¼	40	Gently rolling grassland	6	1-6	VI	1-6	Private
7	42	7	SE¼NW¼;SW¼NE¼	80	Mod. sloping range	14	1-4-6	VII	1-4-6	Private
7	42	8	Lots 6,7;NE¼SW¼	106.32	Steep sloping range	14	1-4-6	VII	1-4-6	Private
7	42	9	NE¼NW¼;SE¼SW¼	80	Mod. to steep sloping	11	1-4-6	VII	1-4-6	Private
7	42	10	NW¼SW¼	40	Steep sloping range	5	1-4-6	VII	1-4-6	Private
7	42	12	NE¼	160	Steep sloping range	15	1-4-6	VII	1-4-6	Private
7	42	19	SE¼	160	Steep sloping range	32	1-4-6	VI	1-4-6	Public
7	42	24	SE¼;S½NE¼	240	Steep sloping range	27	1-4-6	VII	1-4-6	Private
7	42	25	N½NE¼	80	Steep sloping range	9	1-4-6	VII	1-4-6	Private
7	42	27	N½NE¼;SW¼NE¼	120	Gentle sloping range	23	1-4-6	VI	1-4-6	Private
7	42	30	Lots 1-4;E½W½	319.04	Steep sloping grassland	29	1-4-6	VII	1-4-6	Public
7	42	31	Lot 1;NE¼NW¼	79.91	Steep sloping grassland	7	1-4-6	VII	1-4-6	Public
7	42	35	S½SE¼	80	Gentle sloping range	19	1-4-6	VI	1-4-6	Private
7	43	4	Lots 1,2	82.40	Steep sloping range	9	1-4-6	VII	1-4-6	Private
7	43	5	SW¼SW¼	40	Steep sloping range	6	1-4-6	VI	1-4-6	Private
7	43	7	Lots 1,2	91.58	Steep sloping range	8	1-4-6	VII	1-4-6	Private
7	43	9	E½SW¼;W½SE¼;SE¼SE¼	200	Steep sloping range	36	1-4-6	VII	1-4-6	Private
7	43	17	E½SE¼;SE¼NE¼	120	Steep sloping range	13	1-4-6	VII	1-4-6	Private
7	43	18	Lots 2-4;E½NW¼;NE¼SW¼	257.98	Steep sloping range	29	1-4-6	VII	1-4-6	Private
7	43	19	Lots 1-4	184.84	Steep sloping range	21	1-4-6	VII	1-4-6	Private
7	43	21	E½SW¼	80	Gently to steeply rolling	18	1-6	VII	1-6	Private
7	43	29	E½NE¼;NW¼NE¼	120	Steep sloping range	9	1-4-6	VII	1-4-6	Private
7	43	29	W½SE¼;SE¼SE¼	120	Gently to steeply rolling	10	1-4-6	VI/73:VII/47	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
7	43	30	SE¼SW¼	40	Steep sloping range	5	1-4-6	VI	1-4-6	Private
7	43	30	Lot 1;NE¼NW¼	86.39	Steep sloping range	10	1-4-6	VII	1-4-6	Private
7	43	31	NE¼NW¼	40	Steep sloping range	4	1-4-6	VI	1-4-6	Private
7	43	32	E½NE¼	80	Gentle to steep sloping	14	1-4-6	VI/51:VII/29	1-4-6	Private
7	43	33	W½NW¼;SE¼NW¼	120	Gentle to steep sloping	22	1-4-6	VI/81:VII/39	1-4-6	Private
7	44	36	NW¼	160	Mod. rolling grassland	48	1-4-6	VI	1-4-6	Private

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
8	39	1	Lot 1	32.11	Mod. rolling grassland	4	1-2-5	V/5:VI/27	1-2-5	Public
8	39	1	Lot 19	40	Mod. rolling grassland	7	1	VII	1-3	Public
8	39	2	Lot 2	32.89	Gently rolling grassland	5	1	VI	1	Private
8	39	3	Lot 4	30.01	Mod. rolling grassland	6	1-6	VI	1-6	Private
8	39	5	Lot 1	27.92	Steeply rolling;pinon juniper	5	1-4-6	VII	4-6	Private
8	39	13	N½SE¼	80	Mod. rolling grassland	12	1-4-6	VI	1-4-6	Private
8	39	20	S½NE¼	80	Strongly rolling grassland	10	1-6	VII	1-6	Private
8	39	22	E½SW¼	80	Gentle to strongly rolling	21	1-6	VI/65:VII/15	1-4-6	Private
8	39	22	S½NE¼	80	Gentle to strongly rolling	11	1-4-6	VI/47:VII/33	1-4-6	Private
8	39	23	SW¼NW¼	40	Gentle to strongly rolling	5	1-4-6	VI/13:VII/27	1-4-6	Private
8	39	23	SE¼SE¼	40	Mod. rolling grassland	5	1-6	VII	1-6	Private
8	39	25	N½NW¼	80	Mod. rolling grassland	10	1-6	VII	1-6	Private
8	39	27	NE¼SW¼	40	Gentle to strongly rolling; sagebrush	5	1	VI	1	Private
8	39	28	NW¼SW¼;S½NW¼;NE¼NW¼; N½NE¼	240	Strongly rolling grassland	26	1-6	VII	1-6	Private
8	39	33	NW¼;NE¼SW¼	200	Gentle to strongly rolling grassland	62	1-6	VI/155:VII/45	1-6	Private
8	39	33	SW¼SE¼	40	Gentle to strongly rolling grassland	6	1-6	VI/3:VII/37	1-6	Private
8	39	35	E½	320	Mod. rolling grassland	48	1-4-6	VII	1-4-6	Private
8	40	1	NW¼SW¼	40	Steeply rolling grassland	4	1-4-6	VII	1-4-6	Private
8	40	8	SW¼NE¼	40	Mod. rolling grassland	8	1-6	VI	1-6	Private
8	40	9	SW¼;SW¼SE¼;E½SE¼	280	Mod. rolling grassland	47	1-6	VI	1-6	Private
8	40	9	NE¼NE¼	40	Gentle to steeply rolling grassland	8	1-4-6	VII	1-4-6	Private
8	40	10	S½SW¼	80	Mod. rolling grassland	14	1-6	VI	1-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
8	40	11	SE¼SW¼;SW¼SE¼	80	Gentle to strongly rolling grassland	13	1-6	VII	1-6	Private
8	40	14	NW¼;W½NE¼	240	Gentle to strongly rolling grassland	38	1-6	VII	1-6	Private
8	40	15	NW¼;N½NE¼	240	Mod. rolling grassland	41	1-6	VI	1-6	Private
8	40	15	S½SW¼	80	Mod. rolling grassland	11	1-6	VI	1-6	Private
8	40	17	S½;SW¼	80	Gentle to mod. rolling grassland	11	1-4-6	VI	1-4-6	Private
8	40	18	Lots 3,4;E½SW¼;E½	472.13	Gentle to mod. rolling grassland	69	1-4-6	VI	1-4-6	Private
8	40	19	NE¼NW¼;N½NE¼	120	Gentle to mod. rolling grassland	18	1-4-6	VI	1-4-6	Private
8	40	20	N½NW¼	80	Gentle to mod. rolling grassland	11	1-4-6	VI	1-4-6	Private
8	40	20	SE¼SW¼;SE¼;S½NE¼	280	Mod. rolling grassland	42	1-4-6	VI	1-4-6	Private
8	40	21	SE¼SE¼	40	Mod. rolling grassland	7	1-6	VI	1-6	Private
8	40	22	N½N½	160	Mod. rolling grassland	23	1-6	VI	1-6	Private
8	40	23	SW¼NE¼;N½SE¼	120	Mod. rolling grassland	19	1	VI	3	Public
8	40	24	NW¼SW¼	40	Mod. rolling grassland	6	1	VI	3	Public
8	40	24	NE¼SE¼	40	Gentle to steeply sloping; sagebrush	4	1	VII/32:VIII/8	3	Public
8	40	26	N½SW¼	80	Mod. rolling grassland	12	1	VI	1	Private
8	40	27	N½SE¼	80	Mod. rolling grassland	12	1	VI	1	Private
8	40	28	NE¼NW¼;N½NE¼	120	Mod. sloping grassland	21	1-6	VI	1-6	Private
8	40	28	SE¼SE¼	40	Mod. sloping grassland	6	1-6	VI	1-6	Private
8	40	29	NE¼	160	Mod. rolling grassland	24	1-4-6	VI	1-4-6	Private
8	40	30	Lot 2;SE¼NW¼	76.66	Mod. rolling grassland	16	1-6	VI	1-6	Private
8	40	34	SE¼SW¼	40	Level to strongly sloping grassland	4	1-2-6	VII/30:IV/10	1-2-6	Private
8	41	2	Lots 1,2;SE¼NE¼;E½SE¼	200.49	Mod. rolling grassland	54	1-4-6	VI	1-3-4-6	Private
8	41	4	Lots 1,2,3,4;SE¼NW¼; S½NW¼;S½	600.60	Gentle to strongly rolling; pinon-juniper	91	1-4-6	VI/110:VII/490	1-3-4-6	Public
8	41	6	Lot 3	40.07	Steeply sloping;pinon-juniper	5	1-4-6	VI	1-4-6	Private
8	41	9	W½W½	120	Strongly sloping;pinon-juniper	14	1-4-6	VII	1-3-4-6	Public
8	41	12	SW¼SW¼	40	Strongly sloping grassland	7	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
8	41	14	SE¼SW¼	40	Gently sloping grassland	11	1-6	VI	1-6	Private
8	41	33	S½SE¼	80	Gentle to mod. rolling grassland	16	1-6	VI	1-6	Private
8	42	1	NE¼SE¼	40	Mod. sloping grassland	6	1-3-4-6	VII	1-3-4-6	Public
8	42	5	Lots 2,3	84.26	Mod. rolling grassland	8	1-4-6	VII	1-6	Private
8	42	6	Lot 7	8.88	Gentle to steeply sloping grassland	2	1	VII	1	Private
8	42	19	Lots 2,3,4	52.72	Gentle to mod. sloping grassland	14	1	VI	1	Private
8	42	26	W½SW¼	80	Mod. rolling grassland	15	1-6	VI	1-6	Private
8	42	29	E½NE¼	80	Gently rolling grassland	22	1	VI	1	Private
8	42	30	Lots 1,2	38.34	Mod. rolling grassland	9	1	VI	1	Private
8	42	32	NW¼NE¼	40	Gently sloping grassland	11	1	VI	1	Private
8	43	1	Lot 1	40.02	Gently sloping grassland	8	1-6	VI	1-6	Private
8	43	3	S½N½;NE¼SE¼	200	Mod. sloping grassland	28	1-4-6	VI	1-4-6	Public
8	43	4	S½S½	160	Gentle to strongly rolling grassland	18	1-4-6	VII	1-3-4-6	Public
8	43	5	S½SE¼	80	Gentle to strongly rolling grassland	9	1-4-6	VII	1-3-4-6	Public
8	43	6	Lot 3	40.16	Gently sloping grassland	8	1-6	VI	1-6	Private
8	43	8	E½NE¼	80	Strongly rolling grassland	8	1-4-6	VII	1-3-4-6	Public
8	43	9	W½;W½E½;E½SE¼	560	Nearly level to strongly sloping grassland	74	1-4-6	VI/119:VII/441	1-3-4-6	Public
8	43	10	S½	320	Gentle to mod. rolling grassland	60	1-4-6	VII	1-3-4-6	Public
8	43	13	SW¼SW¼	40	Gently rolling grassland	11	1-6	VI	1-6	Private
8	43	14	SE¼SW¼;S½SE¼	120	Gently rolling grassland	31	1-6	VI	1-6	Private
8	43	17	N½SW¼	80	Gently rolling grassland	17	1-6	VI	1-6-9	Public
8	43	18	NE¼NW¼	40	Gently rolling grassland	8	1-6	VI	1-6-9	Public
8	43	18	S½NE¼	80	Gently rolling grassland	17	1-6	VI	1-6-9	Public
8	43	25	S½N½	160	Gentle to mod. rolling grassland	48	1-6	VI/102:VII/58	1-6	Private
8	43	26	SE¼NE¼	40	Mod. rolling grassland	6	1-6	VII	1-6	Private
8	43	28	NW¼NE¼	40	Gently rolling grassland	9	1-6	VI	1-6	Private
8	43	28	SW¼NW¼;W½SW¼	120	Gently rolling grassland	40	1-6	VI	1-6	Public
8	43	29	N½SW¼	80	Gently rolling grassland	14	1-6	VI/44:VII/36	1-6	Private
8	43	29	N½NE¼;SE¼NE¼	120	Gently rolling grassland	28	1-6	VI	1-6	Public
8	43	31	NE¼NW¼	40	Gently sloping grassland	9	1-6	VI	1-6	Private
8	43	33	SW¼;W½NW¼;SE¼NW¼;SW¼NE¼	320	Gently rolling grassland	70	1-6	VI/175:VII/145	1-6	Public

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MONTANA PRINCIPAL MERIDIAN

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Big Horn County										
8	43	34	SW¼SW¼	40	Gently rolling grassland	22	1-2	IV/5:VI/5:VII/30	1-2	Private
8	44	5	Lot 4	25.05	Gently sloping grassland	7	1-6	VI	1-6	Private
8	44	6	Lots 8,21,22,33,34	91.11	Gently sloping grassland	19	1-6	VI	1-6	Private
8	44	9	SW¼SW¼	40	Gently sloping grassland	10	1-6	VI	1-6	Private
8	44	9	SE¼SE¼	40	Strongly sloping grassland	4	1-6	VII	1-6	Private
8	44	11	E½NW¼	80	Mod. sloping grassland	11	1-6	VI	1-6	Private
8	44	19	Lot 5	18.93	Gently sloping grassland	5	1-6	VI	1-6	Private
8	44	19	Lot 8	40	Gently sloping grassland	6	1-6	VI	1-6	Private
8	44	27	E½SW¼	80	Mod. sloping grassland	16	1-6	VI	1-6	Private
8	44	27	E½SE¼	80	Mod. sloping grassland	16	1-6	VI	1-6	Private
8	44	30	Lots 19,20	80	Mod. sloping grassland	21	1-6	VI	1-6	Private
8	44	31	Lots 5,6,15,16	78.20	Gentle to strongly sloping grassland	19	1-4-6	VI/29:VII/49	1-4-6	Private
8	44	34	NE¼NE¼	40	Mod. sloping grassland	8	1-6	VI	1-6	Private
Powder River County										
8	45	1	Lots 1,2,7,8,9,10,15, 16;SE¼	452.81	Mod. rolling grassland	63	1-4-6-9	VII	1-4-6-9	Public
8	45	2	Lots 2,7	60.93	Mod. sloping grassland	12	1-6	VI	1-6	Private
8	45	2	Lot 15	40	Mod. sloping grassland	8	1-6	VI	1-6	Private
8	45	4	Lot 1	22.43	Strongly sloping grassland; conifer	3	1-6	VII	1-6	Private
8	45	11	NE¼NE¼	40	Nearly level;sagebrush-grassland	9	1-6	VI	1-6	Private
8	45	12	E½	320	Nearly level to mod. rolling; sagebrush-grassland	71	1-4-6-9	VI/135:VII/185	1-4-6-9	Public
8	45	13	SE¼	160	Gentle to mod. rolling grassland	36	1-3-4-6-9	VI/113:VII/47	1-3-4-6-9	Public
8	45	24	E½	320	Gentle to mod.rolling grassland	64	1-3-4-6-9	VI	1-3-4-6-9	Public
8	45	25	NE¼;S½	480	Gentle to mod.rolling sagebrush grassland	104	1-3-4-6-9	VI	1-3-4-6-9	Public
8	45	26	SE¼;SW¼NE¼;SE¼SW¼	240	Mod. to strongly rolling grassland	47	1-3-4-6-9	VI	1-3-4-6-9	Public
8	45	31	Lot 1	35.53	Gently sloping grassland	9	1-6	VI	1-6	Private
8	45	31	Lot 3	35.58	Mod. sloping grassland	7	1-6	VI	1-6	Private
8	45	35	E½	320	Strongly rolling grassland	64	1-3-4-6-9	VI	1-3-4-6-9	Public

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Powder River County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
8	46	1	Lot 1	28.68	Gentle to strongly sloping grassland	15	1-6	VI	1-6	Private
8	46	1	NW¼SW¼	40	Gently sloping;conifer-grassland	7	1-6	VI	1-6	Private
8	46	6	Lots 1,2,3	116.56	Strongly rolling grassland	12	1-4-6-9	VII	1-4-6-9	Public
8	46	6	Lots 12,13,17,18;NE¼SW¼	178.29	Gentle to mod. rolling grassland	26	1-4-6-9	VII	1-4-6-9	Public
8	46	6	SE¼SE¼	40	Mod. sloping grassland-conifer	6	1-6	VII	1-6	Private
8	46	7	Lots 1-4;E½NW¼;NE¼SW¼	259.28	Mod. rolling grassland-conifer	34	1-4-6-9	VII	1-4-6-9	Public
8	46	8	SE¼SE¼	40	Gently sloping grassland-conifer	10	1-6	VI	1-6	Private
8	46	13	SE¼SE¼	40	Mod. sloping grassland	5	1-6	VII	1-6	Private
8	46	15	NW¼SW¼	40	Level to strongly sloping grassland	17	1-6	VI	1-6	Private
8	46	17	NE¼NE¼	40	Gently sloping grassland-conifer	10	1-6	VI	1-6	Private
8	46	18	Lots 1,2	70.01	Mod. rolling grassland-conifer	9	1-4-6-9	VII	1-4-6-9	Public
8	46	19	Lots 1-4;E½SW¼;SE¼NW¼	260.92	Gentle to mod.rolling sagebrush grassland	61	1-3-4-6-9	VI	1-3-4-6-9	Public
8	46	20	SE¼SE¼	40	Gently sloping grassland	10	1-6	VI	1-6	Private
8	46	24	NW¼NE¼	40	Mod. sloping grassland	5	1-6	VII	1-6	Private
8	46	28	SW¼NW¼	40	Gently sloping grassland	11	1-6	VI	1-6	Private
8	46	29	NW¼SW¼	40	Gently sloping grassland	10	1-6	VI	1-6	Private
8	46	30	NE¼NE¼	40	Gently sloping grassland	10	1-6	VI	1-6	Private
8	47	2	Lot 3	28.23	Gently sloping grassland	7	1-6	VII	1-4-6	Public

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
9	38	13	Lot 8	15.68	Steeply sloping grassland	3	1-6	VII	1-6	Private
9	38	13	S½SE¼	80	Gentle to strongly sloping grassland	19	1-6	VI/51:VII/29	1-6	Private
9	38	25	NE¼SE¼	40	Mod. sloping grassland	6	1-6	VII	1-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
9	38	36	Lots 1,4,5,8;SE¼;S½NE¼	403.12	Gentle to strongly rolling grassland	66	1-6	VI/11:VII/392	1-6	Private
9	39	1	SE¼SW¼	40	Mod. sloping grassland	5	1-6	VI	1-6	Private
9	39	3	E½SE¼	80	Mod. sloping grassland	18	1-6	VI	1-6	Private
9	39	4	NW¼NE¼	40	Gentle to strongly sloping grassland	7	1-6	VI/8:VII/32	1-6	Private
9	39	9	S½SW¼;SW¼SE¼	120	Strongly rolling grassland	17	1-4-6	VII	1-4-6	Private
9	39	13	NW¼SE¼	40	Strongly sloping grassland	5	1-6	VII	1-6	Private
9	39	20	SE¼SE¼	40	Mod. rolling grassland	7	1-6	VII	1-6	Private
9	39	21	W½W½	160	Mod. rolling grassland	27	1-6	VII	1-6	Private
9	39	22	NE¼SW¼;NW¼SE¼	80	Mod. sloping grassland	26	1-6	VI	1-6	Private
9	39	23	NW¼NW¼	40	Strongly rolling grassland	4	1-4-6	VII	1-4-6	Private
9	39	23	N½SW¼;SE¼SW¼;SW¼SE¼	160	Mod. rolling grassland	27	1-4-6	VII	1-4-6	Private
9	39	26	E½W½;SW¼SW¼	200	Mod. rolling grassland	34	1-4-6	VII	1-4-6	Private
9	39	27	SE¼SE¼	40	Mod. rolling grassland	7	1-4-6	VII	1-4-6	Private
9	39	27	SW¼NW¼	40	Gently rolling grassland	10	1-4-6	VI	1-4-6	Private
9	39	28	S½NE¼	80	Gently rolling grassland	19	1-4-6	VI	1-4-6	Private
9	39	28	NW¼NW¼	40	Mod. rolling grassland	7	1-6	VII	1-6	Private
9	39	28	SE¼SW¼	40	Mod. rolling grassland	5	1-6	VII	1-6	Private
9	39	29	NE¼NE¼	40	Mod. rolling grassland	7	1-6	VII	1-6	Private
9	39	29	Lot 2	30.95	Mod. rolling grassland	4	1-6	VII	1-6	Private
9	39	29	Lot 4;SE¼SW¼	70.70	Mod. rolling grassland	11	1-6	VII	1-6	Private
9	39	34	Lot 3	26.65	Gently rolling grassland	4	1-4-6	VII	1-4-6	Private
9	39	35	Lots 3,4	53.76	Gently rolling grassland	8	1-4-6	VII	1-4-6	Private
9	40	3	NW¼SE¼	40	Gentle to mod.rolling grassland	5	1	VI	1	Public
9	40	3	N½SW¼	80	Gentle to mod.rolling grassland	11	1	VI	1	Public
9	40	4	SW¼NE¼	40	Mod. rolling grassland	4	1	VI	1	Private
9	40	4	NE¼SE¼	40	Gentle to mod.rolling grassland	5	1	VI	1	Private
9	40	5	SE¼SE¼	40	Gently rolling grassland	10	1-4-6	VI	1-4-6	Private
9	40	6	Lots 3,4,5	114.23	Mod. rolling grassland	27	1-4-6	VI	1-4-6	Private
9	40	7	E½	320	Mod.to strongly rolling grassland	36	1-4-6	VII	1-4-6	Private
9	40	8	SW¼;SW¼NW¼	200	Mod.to strongly rolling grassland	22	1-4-6	VII	1-4-6	Private
9	40	8	E½NE¼	80	Gentle to strongly rolling grassland	18	1-4-6	VI/70:VII/10	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
9	40	9	W½NW¼;SE¼NW¼	120	Gentle to strongly rolling grassland	24	1-4-6	VI/91:VII/29	1-4-6	Private
9	40	17	SW¼SW¼	40	Strongly rolling grassland	4	1-4-6	VII	1-4-6	Private
9	40	18	Lots 1,2;E½NW¼	154.95	Mod. rolling grassland	32	1-4-6	VI	1-4-6	Private
9	40	19	NE¼NW¼	40	Strongly rolling grassland	5	1-4-6	VII	1-4-6	Private
9	40	19	NE¼NE¼	40	Strongly rolling grassland	5	1-4-6	VII	1-4-6	Private
9	40	20	NW¼NE¼	40	Strongly rolling grassland	4	1-4-6	VII	1-4-6	Private
9	40	23	W½SE¼	80	Gentle to mod. rolling grassland	21	1-4-5-6	VI	1-4-6	Private
9	40	25	SE¼SE¼	40	Mod.rolling grassland	6	1-4-6	VII	1-4-5-6	Private
9	40	26	NE¼SW¼	40	Gentle to mod.rolling grassland	9	1-6	VI/28:VII/12	1-3-6	Public
9	40	35	NE¼NE¼	40	Mod.rolling grassland	7	1-6	VI	1-4-6	Private
9	41	2	Lot 8;S½NW¼;E½SW¼;SW¼SW¼	222.11	Gentle to strongly rolling grassland	36	1-4-6	VI/46:VII/176	1-4-6	Private
9	41	3	NW¼SW¼	40	Gently sloping grassland	9	1-6	V/10:VI/30	1-6	Private
9	41	4	Lot 7	29.61	Mod.rolling grassland	5	1-6	VI	1-6	Private
9	41	11	NW¼NW¼	40	Gentle to strongly rolling grassland	6	1-4-6	VI/8:VII/32	1-4-6	Private
9	41	12	Lots 3,4;W½SE¼	157.10	Gentle to strongly rolling grassland	34	1-4-6	VI/54:VII/103	1-3-4-6	Public
9	41	13	Lots 1,2,3,4;W½E½	307.80	Nearly level to strongly rolling grassland	59	1-4-6	VI/139:VII/168	1-3-4-6	Public
9	41	15	NW¼SE¼	40	Gently sloping grassland	9	1-2-6	VI	1-6	Private
9	41	17	W½SW¼	80	Gently sloping grassland	16	1-4-6	VI/66:VIII/14	1-4-6	Private
9	41	19	Lots 5,6;SE¼NW¼	109.33	Gently to strongly sloping grassland	21	1-4-6	VI/65:VII/44	1-4-6	Private
9	41	19	NE¼NE¼	40	Gently sloping grassland	8	1-4-6	VI	1-4-6	Private
9	41	20	NW¼NW¼	40	Gently sloping grassland	8	1-4-6	VI	1-4-6	Private
9	41	21	SW¼;S½NW¼;SW¼NE¼;W½SE¼	360	Gently to strongly rolling-sagebrush	69	1-4-6	VI/252:VII/108	1-3-4-6	Public
9	41	24	Lots 1,2;W½NE¼	150.75	Mod.rolling grassland	27	1-4-6	VI	1-3-4-6	Public
9	41	27	W½W½;SE¼NW¼;NE¼SW¼	240	Gentle to strongly rolling-sagebrush	60	1-4-6	VI/235:VII/5	1-3-4-6	Public
9	41	28	E½;E½W½;NW¼SW¼	520	Gentle to strongly rolling-sagebrush grassland	94	1-4-6	VI/457:VII/63	1-3-4-6	Public
9	41	30	SE¼SE¼	40	Strongly rolling grassland	4	1-4-6	VII	1-4-6	Private

Appendix A -- Description, classification, suitability and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Tongue River Area, Montana and Wyoming.

MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
9	41	32	Lots 7,8;N½SE¼;NE¼	304.92	Strongly rolling grassland	31	1-4-6	VII	1-3-4-6	Public
9	41	33	All	612.28	Gentle to strongly rolling grassland	65	1-4-6	VI/29:VII/583	1-3-4-6	Public
9	41	34	Lots 5,6,7,8;N½SE¼ NW¼;S½NE¼	534.90	Mod.to strongly rolling grassland	77	1-4-6	VI/221:VII/313	1-3-4-6	Public
9	41	35	Lots 5,6;N½SW¼;SW¼NW¼	187.58	Mod.rolling grassland	39	1-4-6	VI	1-3-4-6	Public
9	42	19	Lots 1,2,3,4;E½W½; E½SE¼;SE¼NE¼;W½E½	576.08	Nearly level to strongly rolling grassland	118	1-4-6	VI/373:VII/203	1-3-4-6	Public
9	42	26	NE¼	160	Gently sloping grassland	38	1-4-6	VI	1-4-6	Private
9	42	30	All	625.32	Gentle to strongly rolling grassland	172	1-4-6	VI/611:VII/14	1-3-4-6	Public
9	42	33	Lot 1	40.27	Gently rolling grassland	7	1-4-6	VI	1-4-6	Private
9	43	6	Lot 1	40.65	Gently rolling grassland	8	1-4-6	VI	1-4-6	Private
9	43	8	NE¼SW¼;N½SE¼;S½NE¼; NE¼NE¼	240	Mod. rolling grassland	56	1-4-6	VII	1-4-6	Private
9	43	9	NW¼NW¼	40	Mod.rolling grassland	9	1-4-6	VII	1-4-6	Private
9	43	14	S½SE¼	80	Mod.rolling grassland	14	1-4-6	VI	1-4-6	Private
9	43	17	S½SW¼	80	Mod.rolling grassland	20	1-4-6	VI	1-4-6	Private
9	43	18	SE¼SE¼	40	Mod.rolling grassland	10	1-4-6	VI	1-4-6	Private
9	43	18	Lots 2,3	96.14	Gently rolling grassland	25	1-4-6	VI	1-4-6	Private
9	43	19	SE¼;SE¼NE¼	200	Gently sloping grassland	42	1-4-6	VI	1-4-6	Private
9	43	23	NE¼	160	Mod.rolling grassland	29	1-4-6	VI	1-4-6	Private
9	43	26	NE¼NE¼	40	Gently rolling grassland	11	1-6	VI	1-6	Private
9	43	28	NE¼NE¼	40	Gently rolling grassland	10	1-6	VI	1-6	Private
9	43	29	SW¼NW¼	40	Strongly sloping grassland	7	1-4-6	VII	1-4-6	Private
9	43	30	NE¼NW¼	40	Mod. sloping grassland	11	1-4-6	VI	1-4-6	Private
9	43	32	E½SE¼	80	Gently rolling grassland	22	1-6	VI	1-6	Private
9	43	34	SE¼SW¼	40	Mod.rolling grassland	11	1-6	VI	1-6	Private
9	43	35	SW¼NE¼	40	Gently rolling grassland	8	1-6	VI	1-6	Private
9	44	2	W½NE¼	80	Mod.rolling grassland	20	1-6	VI	1-6	Private
9	44	2	NE¼SE¼	40	Mod. sloping grassland	7	1-6	VII	1-6	Private
9	44	6	Lots 1,2,8,9,10,11,12, 13,14,15,16,17,18; E½SE¼	560.02	Gently rolling grassland	193	1-4-6	VI	1-4-6	Public
9	44	7	Lots 6,15,16	60.97	Gently rolling grassland	16	1-6	VI	1-6	Public
9	44	7	Lots 19,20;S½SE¼	160	Mod.rolling grassland	42	1-4-6	VI	1-4-6	Public

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MONTANA PRINCIPAL MERIDIAN

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
9	44	8	SW$\frac{1}{4}$	160	Gentle to mod.rolling grassland	53	1-4-6	VI	1-4-6	Public
9	44	9	S$\frac{1}{2}$SE$\frac{1}{4}$	80	Gently rolling grassland	12	1-6	VI	1-6	Public
9	44	11	E$\frac{1}{2}$SW$\frac{1}{4}$	80	Mod.rolling grassland	13	1-6	VI	1-6	Private
9	44	15	SW$\frac{1}{4}$	160	Mod.rolling grassland	27	1-6	VI	1-6	Public
9	44	18	NE$\frac{1}{4}$NE$\frac{1}{4}$	40	Mod.rolling grassland	11	1-4-6	VI	1-4-6	Public
9	44	19	Lot 15	21.03	Gently rolling grassland	3	1-6	VI	1-6	Public
9	44	26	SW$\frac{1}{4}$NW$\frac{1}{4}$	40	Gently rolling grassland	13	1-6	VI	1-6	Private
9	44	26	NW$\frac{1}{4}$SE$\frac{1}{4}$	40	Level to mod.rolling grassland	14	1-6	VI	1-6	Private
9	44	27	NE$\frac{1}{4}$SW$\frac{1}{4}$	40	Mod.sloping grassland	13	1-6	VI	1-6	Private
9	44	30	E$\frac{1}{2}$;Lots 11,19,20	440	Mod.sloping grassland	87	1-4-6	VI/200:VII/240	1-4-6	Public
9	44	33	Lots 4,5	80	Mod.sloping grassland	19	1-6	VI	1-6	Private
9	44	33	Lot 1	40	Mod.sloping grassland	6	1-6	VI	1-6	Private

Powder River County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
9	45	1	N$\frac{1}{2}$;SE$\frac{1}{4}$;S$\frac{1}{2}$SW$\frac{1}{4}$	560	Strongly rolling grassland	111	1-3-4-6-9	VI	1-3-4-6-9	Public
9	45	2	NE$\frac{1}{4}$	160	Strongly rolling grassland	32	1-3-4-6-9	VI	1-3-4-6-9	Public
9	45	10	S$\frac{1}{2}$SW$\frac{1}{4}$	80	Strongly rolling grassland	13	1-6	VII	1-6	Private
9	45	12	E$\frac{1}{2}$	320	Gentle to strongly rolling grassland	57	1-3-4-6-9	VI/106:VII/214	1-3-4-6-9	Public
9	45	13	S$\frac{1}{2}$NE$\frac{1}{4}$;S$\frac{1}{2}$SE$\frac{1}{4}$	160	Mod.to strongly rolling grassland	40	1-3-4-6-9	VI/80:VII/80	1-3-4-6-9	Public
9	45	22	E$\frac{1}{2}$NE$\frac{1}{4}$	80	Mod.sloping grassland	24	1-6	VI	1-6	Private
9	45	24	E$\frac{1}{2}$	320	Gentle to mod.rolling grassland	99	1-3-4-6-9	VI	1-3-4-6-9	Public
9	45	25	E$\frac{1}{2}$	320	Gently rolling grassland	97	1-3-4-6-9	VI	1-3-4-6-9	Public
9	45	26	All (except 13 acres in Powder River Area)	627	Gently rolling grassland	165	1-4-6	VI	1-4-6	Public
9	46	2	NE$\frac{1}{4}$SW$\frac{1}{4}$	40	Gently rolling grassland	9	1-6	VI	1-6	Private
9	46	6	Lots 1-4	142.84	Strongly rolling grassland	29	1-3-4-6-9	VI	1-3-4-6-9	Public
9	46	7	Lots 1-4;NE$\frac{1}{4}$NW$\frac{1}{4}$;E$\frac{1}{2}$SW$\frac{1}{4}$	263.40	Strongly rolling grassland	60	1-3-4-6-9	VI/110:VII/153	1-3-4-6-9	Public
9	46	11	NE$\frac{1}{4}$NE$\frac{1}{4}$	40	Gently sloping grassland	8	1-6	VI	1-6	Private
9	46	11	SW$\frac{1}{4}$NE$\frac{1}{4}$	40	Gently sloping grassland	10	1-6	VI	1-6	Private
9	46	11	NE$\frac{1}{4}$SE$\frac{1}{4}$	40	Mod.sloping grassland	10	1-6	VI	1-6	Private
9	46	13	W$\frac{1}{2}$SW$\frac{1}{4}$	80	Mod.sloping grassland	29	1-6	VII	1-6	Private
9	46	14	W$\frac{1}{2}$SW$\frac{1}{4}$	80	Strongly sloping grassland	13	1-6	VII	1-6	Private

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MONTANA PRINCIPAL MERIDIAN

Powder River County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
9	46	14	NW¼SE¼	40	Mod.sloping grassland	14	1-6	VI	1-6	Private
9	46	18	All	623.96	Mod.to strongly rolling grassland	176	1-3-4-6-9	VI/495:VII/128	1-3-4-6-9	Public
9	46	19	Lots 1-4;NE¼NW¼	184.68	Gentle to mod.rolling grassland	58	1-3-4-6-9	VI	1-3-4-6-9	Public
9	46	23	SE¼NW¼	40	Mod.sloping grassland	14	1-6	VI	1-6	Private
9	46	24	Part of NE¼NW¼	18	Mod.sloping grassland	6	1-6	VII	1-6	Private
9	46	26	SW¼SE¼;Part of S½SW¼	60	Gently sloping grassland	13	1-6	VI	1-4-6	Public
9	46	28	Part of NW¼SE¼	19	Nearly level grassland	6	1-6	VI	1-6	Private
9	46	30	W½	305.48	Gently rolling grassland	92	1-3-4-6-9	VI	1-3-4-6-9	Public
9	46	31	Part of Lot 1;Part of NE¼NW¼;Part of NW¼NE¼; Part of SW¼NE¼; Part of SE¼NW¼	58	Gently rolling grassland	18	1-3-4-6-9	VI	1-3-4-6-9	Public
9	47	5	Part of W½	116	Nearly level grassland	24	1-6	VI	1-6	Public
9	47	7	Part of S½	62	Gently sloping grassland	15	1-6	VI	1-6	Public
9	47	8	Part of NW¼	40	Gently sloping grassland	9	1-6	VI	1-6	Public

Big Horn County

Twp South	Range East	Sec.	Subdivision	Acres	General Land Character	AUM's	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
10	38	1	Lot 7	41.39	Strongly sloping grassland	9	1-6	VII	1-6	Private
10	42	1	Lots 1,2,3,4;SW¼NW¼	102.40	Gently sloping grassland	28	1-4-6	VI	1-4-6	Private
10	42	4	Lots 3,4	25.85	Gentle to mod.sloping grassland	5	1-4-6	VI	1-4-6	Private
10	42	5	Lots 1,2,3,4	52	Gentle to mod.sloping grassland	15	1-4-6	VI	1-4-6	Private
10	42	6	Lots 1,2,3,4,5,6	135.54	Gentle to mod.sloping grassland	46	1-4-6	VI	1-4-6	Private
10	43	1	Lots 1,2,3;NE¼;E½NW¼	300.12	Gentle to strongly rolling grassland	62	1-6	VI	1-6	Private
10	43	4	E½NE¼	80	Gently sloping grassland	26	1-6	VI	1-6	Private
10	43	5	Lot 1;E½NE¼	98.65	Gently sloping grassland	26	1-6	VI	1-6	Private

Appendix A (continued)

The following tracts of land were classified but disposed of before the report was published:

MONTANA PRINCIPAL MERIDIAN

Custer County

Twp North	Range East	Sec.	Subdivision	Acres
3	49	14	NW¼	160
3	49	34	W½NW¼	80
3	49	34	SE¼SE¼	40
4	45	22	NE¼SW¼	40

6th PRINCIPAL MERIDIAN, WYOMING

Sheridan County

North	West			
57	80	6	Lots 5,6,11,12	95.49
57	80	7	Lot 3	23.99
57	80	8	S½SW¼;NW¼SW¼	120
57	81	1	Lot 9	27.67
57	81	1	N½SW¼;SW¼SW¼	120
57	81	5	SW¼NE¼	40
57	81	11	E½NE¼	80
57	81	12	All	441.20
57	81	13	SW¼NW¼	40
57	81	14	SE¼NE¼	40
58	81	19	SW¼SW¼	40
58	81	19	SE¼SE¼	40
58	81	29	SE¼NE¼;NE¼SE¼	80
58	81	29	NE¼SW¼	40
58	81	29	W½NW¼	80
58	81	30	E½NE¼;SW¼NE¼	120
58	81	30	NW¼NW¼;SW¼SW¼	80
58	81	32	NE¼SW¼	40
58	82	21	SE¼SE¼	40
58	82	25	NE¼NE¼;S½NE¼;NW¼SE¼;NE¼NW¼; S½NW¼;NE¼SW¼	320
58	82	35	NE¼NE¼	40

Appendix A (continued)

MONTANA PRINCIPAL MERIDIAN

Rosebud County

Twp South	Range East	Sec.	Subdivision	Acres
5	41	18	NW¼SE¼	40
5	41	18	Lots 5,6	76.51
6	42	14	N½SW¼	80
6	42	15	S½	320
6	42	22	N½NW¼;SE¼NW¼;W½NE¼	200
6	42	28	NE¼NW¼	40
6	42	35	Lot 1;S½NE¼;SE¼	285.97
6	42	5	Lot 4	38.93

APPENDIX B

Section 1 History

Section 2 Vegetation, Wildlife, Erosion and Water - Early Journals

Section 3 Photographic Comparisons for Trend

Section 4 Soils

Section 5 Erosion - Piping

Section 6 Economic and Social Development

Section 7 Land Classification Reconnaissance (Circa 1924)

Section 8 Annual Plants

The history of the Tongue River begins with doubts ! The Verendryes, exploring for the King of France, are popularly supposed to have reached the Tongue River Basin in 1743. Some historians, with good reason, doubt they ever entered Montana.

The first authentic narrative of the Tongue River is that of Larocque, a Canadian in the employ of the Northwest Fur Company, who in 1805 entered the basin at the southern end near the mountains, crossed it in August and passed the area again in September 1805 on his way home to Fort LaBosse in Canada.

The following year, 1806, Clark on his way down the Yellowstone River to join Lewis on the Missouri, passed the mouth of the Tongue River.

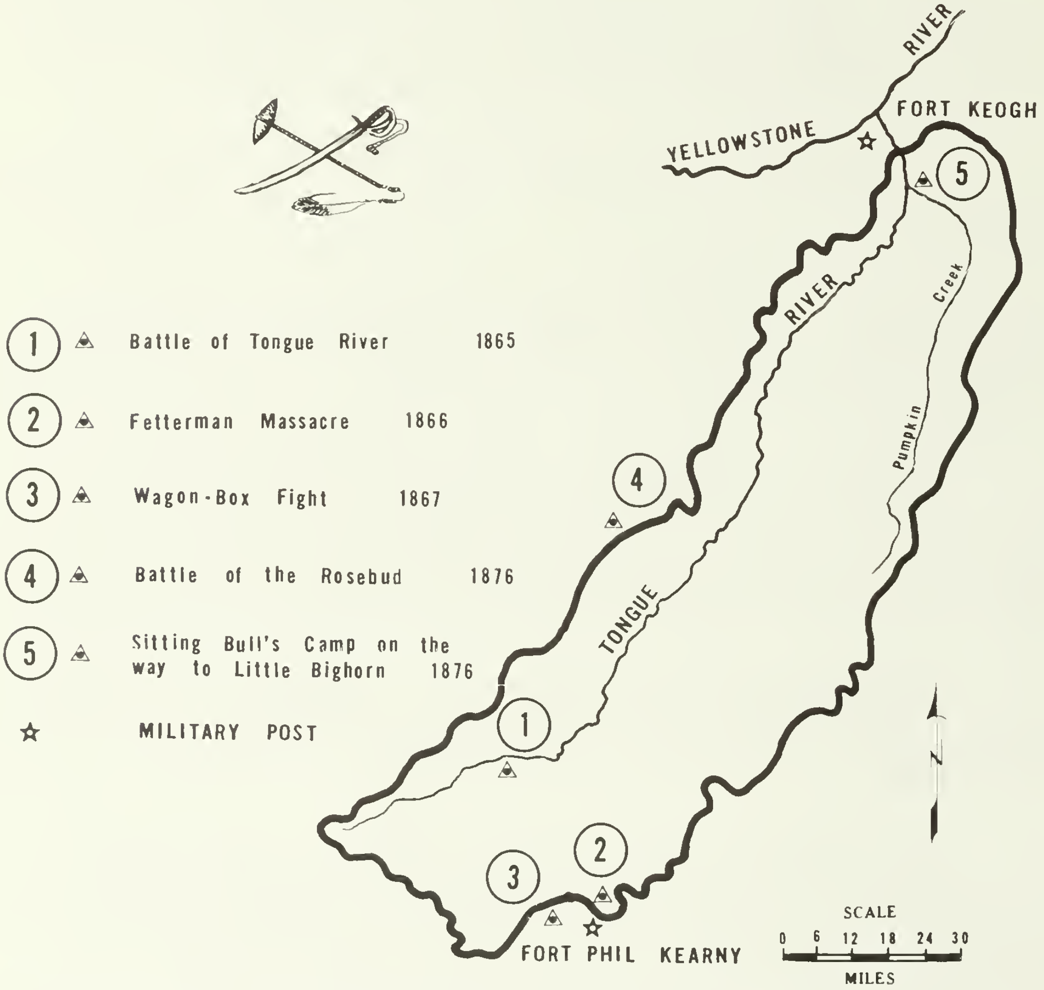
Raynolds crossed the basin twice in 1859. One of his officers took an independent route crossing the basin in 1859 and passed the mouth of the Tongue again in 1860. These men left detailed accounts of their trips.

The open rolling land, well-grassed and watered, at the base of the Big Horn mountains was a good north-south route. Control of the route was essential to Indian and white. Along this way in 1865, near the present town of Ranchester, Wyoming, General Connor defeated 700 Arapahoe under Chiefs Black Bear and Old David. Figure 38.

The following year, 1866, Captain Fetterman and a detail of 81 men out of Fort Phil Kearny were killed. Fetterman violating explicit orders pursued a few fleeing Indians into an ambush of 1500 to 2000 Sioux.

The next year Chief Red Cloud with 3000 mounted Sioux attacked Major Powell on a wood-collecting detail with a few men. The soldiers formed by the wagons to withstand repeated heavy attacks. Sioux losses were so heavy they would never discuss this battle, "The Wagon-Box Fight", figure 13. To the north of Fort Phil Kearny, on the Tongue River-Rosebud Creek Divide, General Crook and 1325 men defeated a slightly superior force of Indians at the "Battle of the Rosebud". Fort Keogh, at Miles City, remained relatively quiet during this entire period.

Nelson Story, who brought the first cattle into Montana, commented daily on the herds of buffalo along the Yellowstone in 1880. Yet by 1882 the one-half million buffalo of the northern herd had been destroyed by the hide hunters. The open range was soon blackened by the first herds of cattle brought in for the grazing and the newly created local western market for beef; the Indians held on reservations and unable to hunt for meat were starving; to feed them the government bought local beef.



RIVER
FORT KEOGH
YELLOWSTONE
5
RIVER
Creek
Pumpkin
4
TONGUE
1
2
3
FORT PHIL KEARNY
SCALE
0 6 12 18 24 30
MILES
1 Battle of Tongue River 1865
2 Fetterman Massacre 1866
3 Wagon-Box Fight 1867
4 Battle of the Rosebud 1876
5 Sitting Bull's Camp on the way to Little Bighorn 1876
☆ MILITARY POST

Figure 38 Indian Battles, Tongue River Area

Until 1884 the livestock industry of the Great Plains ballooned. That year a drought hit; the following year was dry. It was then, in 1885, President Cleveland ordered troops to drive all trespass livestock, approximately one-quarter of a million head, off the Indian reservations.

The range feed was already short and these new cattle numbers added to the desperate range problem - then disaster really struck. In the severe winter of 1886-1887 cattle perished from cold and hunger by the tens of thousands; the Tongue River Basin suffered with the rest of the plains. Many livestock companies collapsed.

The introduction of alfalfa spurred interest in haying. Even before the winter of 1886-1887 some ranches, especially sheep ranches, had already started to raise winter feed. The disaster was the proof that constant care of stock and winter feed was necessary and could be best given by small ranches. The vast cattle empires disappeared to be replaced by ranch operations much like those of today.

Agriculture, surprisingly, had its start in western Montana and moved to the east. By 1879 the emigration eastward met settlers coming westward up the valley of the Yellowstone. Small ranches, given an impetus by the livestock disaster of the winter of 1886-1887, mounted in number. Custer County, for example, listed 76 herds with over 500 head, and 244 herds of a smaller size in 1883. By 1890, in only seven years, but 25 herds remained with over 500 head, and the smaller herds had increased to a total of 334. Stock farming had come into its own.

The lower end of the Tongue River remained essentially the stock raising area which it is today. The expansion of farming had less effect there than on the fertile dry lands to the north and east.

The Northern Pacific Railroad was laid along the easy grades of the Yellowstone River and reached the mouth of the Tongue River by 1882. Transportation by rail ended the shipper's dependence on the riverboats of the Missouri and Yellowstone Rivers. At the south end of the basin in the mid-1800's,the Burlington Railroad crossed the plains of eastern Wyoming to the Big Horn mountains then skirted along their base north through the upper reaches of the Tongue River and westward to join the Northern Pacific at Billings, Montana.

Industry has declined generally in the Tongue River Basin. The Chicago, Burlington and Quincy Railroad has shifted its shops westward from Sheridan. The brewery has ceased operations and the beet sugar refinery has moved north 50 miles to the beet fields surrounding Hardin.

Coal, at one time,dominated the industrial field, but has dropped sharply in importance. The coal resources of the Tongue River Area are huge; at one time they were a major source of coal for the railroads. These coal beds are a stake in future industrial expansion.

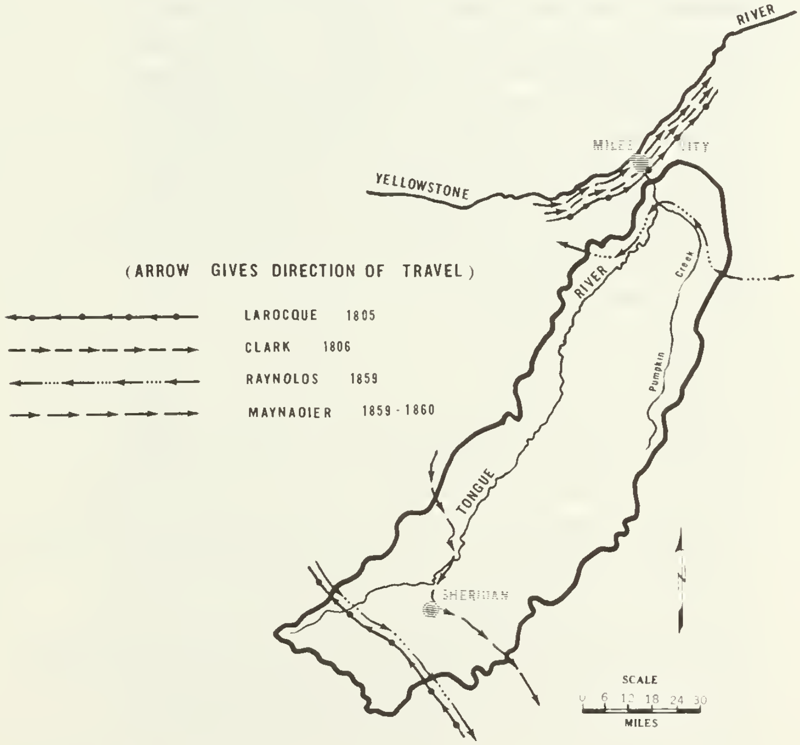
Hydro-electric potential of the Tongue River is limited and but one privately owned plant is located at Sheridan. Thermo-electric power based on coal seems unlimited and represents another possibility for future expansion in industry.

APPENDIX B Section 2

VEGETATION, WILDLIFE, EROSION AND WATER
Excerpts from the Early Journals

Larocque, an agent of the Northwest Fur Company, came up the Powder River in July 1805, crossed the Tongue River near its source, and went on northwestward; he returned east past the mouth of the Tongue in August. The following year, 1806, Clark, of the Lewis and Clark Expedition, described the Tongue River and the country at its mouth. In 1859 the Army, continuing its western exploration, sent a party under Captain Raynolds that crossed the lower part of the Tongue River Basin, moved up the valley and out of it and later broke off a small group under the command of Lieutenant Maynadier, who recrossed the upper third. In 1860, Maynadier retraced Clark's route down the Yellowstone River past the Tongue's mouth.

Routes of the Early Explorers



(Note: The Verendryes were west of the Missouri in 1743, they may have crossed the Tongue but are not cited here. Their locations are in extreme doubt. Their journals were written after their return to civilization and they gave their own names for tribes and places. Some historians believe their "Shining Mountains" were the Laramie Range south of Casper, Wyoming.)

Vegetation, Wildlife, Erosion and Water
Excerpts from the Early Journals

The narratives include information on range vegetation, timber and wildlife, water and erosion. Items of special interest such as grass and water are mentioned daily. The Tongue River was reconnoitered with less detail than the adjoining basins to the east and to the west, but these basins are similar and have observations applicable also to the Tongue. The Upper Yellowstone Report, 1965, covers the area to the west as does the Middle Yellowstone Report, now in preparation.

One hundred and eight years ago, in 1859, Captain Raynolds U. S. Army topographic engineer summarized the entire Tongue River valley and its potentials:

> "...Tongue River rises in the Big Horn mountains and is in some respects an improvement upon the Powder. Its valley is narrower, but contains less sage and more grass. The stream flows in the main over a gravel or stony bottom, and thus presents no especial obstructions to crossing. The river bottom is less torn up by gullies, and the bluffs are not as rugged and impassable. Yet the Tongue river valley presents few attractions to the settler. The soil is light, and the timber chiefly cottonwood and scarce - disadvantages that will for years seriously affect its prospects for settlement and development..."

The Powder with which it is compared was even less appealing:

> "...The Powder itself rises in the Big Horn mountains, about latitude 43° 25', flows northeast about 60 miles then turns to the north, and empties into the Yellowstone in latitude 46° 42'. Its valley (which is barren and yields but little grass and an abundance of artemisia) averages a mile in width through its entire length, until within 50 miles from its mouth, it becomes narrower and the bluffs more ragged and broken. Travelling in it is greatly impeded by deep and almost impassable ravines which cross it at nearly right angles, and are concealed by the sage until their very edge is reached. These gullies are caused by the action of the water upon the light soil, and are among the most disagreeable features of the country. The bed of the river is mainly a treacherous quicksand, and great care is necessary in

> selecting fords. The depth of the water is not, however, such as to offer an obstruction, except during freshets. The bluffs bordering the valley are throughout the much-dreaded and barren 'bad lands', and this must ever remain of little or no value to the country..."

Larocque is quoted at greater length under Wildlife in this Annex as he was more interested in game in the upper Tongue, but in August 1805 he was going downstream along the Yellowstone River and reported, using French for cottonwoods - "Liards" and later "Loir[d]s" and "la Langue" for the lower Tongue River:

> "...Saturday 21st. We had a very bad road Came down the River to see if we could find a better passage but it was impossible, the River striking the Rock at every bend and assended the hill again and with difficulty made our way over Rocks. After sun set we encamped on the River a la Langue killed 2 Elks which were very fat. Course East for 18 miles wind N. E...
>
> "Sunday 22nd. We crossed the River a la Langue and passed over a plain of about 9 miles in breadth where we came again to Rocks and precipices without number over which we jogged on without stopping till 2 hours before sun set when we encamped on the side of the River close to a Rapid. There is little or no wood here along the River except a few Liards scattered here and there and no grass at all..."

Captain William Clark the following year wrote on the 29th of July, calling the Yellowstone the "rochejhone":

> "...late in the evening I arrived at the entrance of a River which I take to be (called by the Indians) the [Lazeka or Tongue River] it discharges itself on the Star^d Side and is 150 yards wide of water the banks are much wider. I intended to encamp on an eligable spot immediately below this river, but finding that it's water [is] so Muddy and worm as to render it very disagreeable to drink, I crossed the rochejhone and encamped on an island close to the Lar^d Shore. The water of this river is nearly milk worm very muddy and of

> a lightish brown colour. the current rapid and the channel contains great numbers of snags. near its enterance there is great quantities of wood such as is common in the low bottoms of the Rochejhone and Missouri (it heads in Cote Noir has 2 branches 1 heads with the Chayenne and 1 with one of the Big H's branches) tho' I believe that the country back thro' which this river passes is an open one where the water is exposed to the sun which heats it in its passage. it is Shallow and throws out great quantities of mud and some cors gravel..."

Just below the Tongue, Clark again comments on the sediment load of the Yellowstone tributaries with:

> "...I landed at the enterance of a dry Creek on the Lar^{d} side below the Shoals and took brackfast. Those Dry Rivers, Creek &c are like those of the Missouri which take their rise and are the conveyance of the water from those plains. they have the appearance of discharging emence torrents of water. the late rains which has fallen in the plains raised suddenly those Brooks which receive the water of those plains on which those suden and heavy showers of rain must have fallen, Several of which I have seen discharging those waters, whiles those below heading or takeing their rise in the same neighbourhood, as I passed them appears to have latterly been high. those Brood[k]s discharge emencely of mud also, which contributes much to the muddiness of the river. after Brackfast proceeded on the river much narrower than above from 3 to 400 yards wide only and only a fiew scattering trees to be seen on the banks..."

Captain Raynolds, in 1859, continued the mission of the Army topographic engineers by exploring the upper Yellowstone River. The Powder River, in August, was rough traveling and short of feed; traveling west on the 3rd of August towards the Tongue River valley, Raynolds observed: "...The grass on the hills was scarce but excellent in quality..."

But on the 4th of August Raynolds' hopes of better forage and traveling suffered disappointment: 1/

1/ A part of this quotation is given in the main text.

> " We were soon again among the 'bad lands' whose acquaintance we had formed upon the Powder and this amalgamation of sterile clay and stone, washed into gullies and totally devoid of vegetable life, surrounded us upon all sides. The steepness of the descent also rendered it impossible for us to abandon the ridge and enter the valley, after a long march, we reached a deep gorge badly torn up by irregular ravines... Our progress was delayed by other gullies, so that we did not reach the stream and encamp until about 2 o'clock p.m. We found water in abundance standing in pools, but of poor quality. The grass was scanty and miserable and it was only after a long search, that we found pasturage of any description for our tired beasts. A further advance, however, was clearly impossible. We therefore remained here after a laborious march of eight hours, the distance travelled being 13½ miles...
> "...The work to-day has been the most arduous by far yet imposed upon the expedition, and I should have pronounced the road travelled impracticable if it had not been actually passed over..."

Raynolds pressed on, however, for the only day of rest for the expedition was Sunday.

> "...Friday, August 5. - The stream upon which we are encamped is called by Bridger Pumpkin creek, taking its name from a species of wild gourd that is said to be found upon its banks. Its bed is some 30 or 40 yards wide, and in the wet season would be impassable. The stream is not of great length, but empties into Tongue river some six or eight miles below this point. Our route this morning lay down its valley, crossing the creek every few hundred yards, as its course is very crooked, and the nature of the country prevents our leaving its banks. The soil is sandy and the strength of our mules has consequently been much overtasked.
> "After a march of this character for six miles, we passed over a low ridge to Tongue river, which at first resembled a mere tributary of Pumpkin creek. Its valley is no wider, and at this point there is but little timber, and, as the water was wholly invisible, the creek apparently was the larger.

> Upon a closer approach, however, Tongue river was found to be a fine rapid stream, from 70 to 100 uards in width and 13 inches deep, flowing over a gravelly bottom. Its water is clear and for the season very cold.
>
> " Upon reaching its banks we looked in vain for grass for our animals....The little that was found proved totally insufficient, and we therefore encamped in a grove of young cottonwoods, and supplied the deficiency in pasturage by our previous expedient of lopping off and feeding to the mules and horses the young and succulent boughs..."

On the 6th, on the Tongue River valley, the way grew easier:

> "...Saturday, August 6.- Our march to-day has been short and easy, and we advanced only about five and a half miles up the level valley of Tongue river. The stream is very sinuous, and we are compelled to cross it three times, but it is not deep enough to embarrass fording. Its valley is much narrower than that of the Powder river, but the adjacent hills are less 'washed' and barren. Timber is scarcer, and grass decidely more abundant, the latter fact being directly explained by the presence of buffalo in fewer numbers.
>
> " Our camp is in a fine grove of cottonwoods, with an excellent growth of grass beneath them, which with the rest of tomorrow, will, I trust, recuperate our animals, whose condition has become so reduced that short marches have lately been an absolute necessity..."

That night Raynolds pondered on the vegetation in this region and concluded:

> "...Is it not this dryness of the climate the cause of the great scarcity of vegetation in this region, and is not this the leading fact to be considered in forming an estimate of its agricultural character ? If this present extreme drought is regular and prevails each season, the scarcity of trees is sufficiently explained, and the impossibility of the soil, however good, repaying cultivation fairly demonstrated. An examination of the soil itself in many places reveals no sufficient reason for the scarcity of timber, which is found only on

> the banks of water-courses, and in ravines near the summits of the highest hills, where moisture is most abundant, and we must therefore seek other causes. Are they not found in the dryness that so universally prevails elsewhere?..."

During the next day of travel before leaving the basin, enroute westward to the Yellowstone: "...The road was tolerably good, the sage constituting the chief obstruction..."

Lieutenant Maynadier split away from the main party at the mouth of the Big Horn, headed up Tullocks Creek to the Rosebud, then back across the Tongue and onto the Powder.

Of the Tongue, in September 1859, as he entered the valley about 20 miles north of the present site of Decker, Montana:

> "...To the north the surface of the country is one mass of barren peaks, filling the whole space between Rosebud and Tongue rivers, and forming the middle of the three ranges of the Wolf mountains. Any attempt to traverse it with wagons is useless...we reached the Tongue river, having a good road in its valley, only interrupted in a few instances by ravines not very difficult to cross, and with good crossings of the stream when they became necessary.
>
> " The character of this river at this point is similar to that below. It is 30 yards wide, flowing in a bold stream over a bottom of stones and coarse pebbles. Its general course is east of north, though its bed is very crooked and winding. It is well-timbered, and an abundance of good grass is found on its banks. The hills bordering the valley are low and rounded, but immediately behind them comes the chain of barren clay peaks which had hemmed us in from the start..."

Raynolds paralleling Maynadier wrote of the upper Tongue:

> "...Our route today bore directly across Tongue river (a beautiful mountain torrent about 40 feet wide and a foot or more in depth) and thence over the hills in a south east course, keeping nearly parallel to the mountains, but approaching them gradually. We crossed the heads of several small tributaries to Tongue river, the undulations

> of the surface being slight. A flat plateau separated the streams, the valleys of which were broad and beautiful. One narrow brook, flowing in a cut some eight or ten feet deep, was the only one that we experienced any difficulty in crossing..."

Prickly pear was common. Two forms occur in the Tongue River Basin, the flat oval pads which are well-known and easily recognized, and the brittle prickly pear which is a far more annoying plant as Maynadier in 1860 found:

> "...a species of prickly pear, consisting of small balls covered with thorns....The little torments really seemed to have the power to leap from their stems and stick to some luckless mule. whose outrageous kicking and plunging was the only sign of mischief..."

In summary , on the public domain lands the erosion, the rates of soil loss, the quantity and quality of water, and the quantity and quality of forage were probably not much different then than they are now.

Wildlife

The Tongue River Basin and the rest of the valleys of the Yellowstone River were good wildlife habitat.

Of the Tongue River in August 1805 Larocque wrote:

> "...Monday 12th. In the evening the young men that had been sent to reconnoitre returned and reported that there was plenty of Buffaloes and fruit on the tongue and small horn River..."

On August 15th, in the south part of the basin, Larocque noted:

> "...encamped on another branch of the Tongue River. Wind N. W. fine warm weather. The Indians Killed Buffaloes and a few Bears, the latter they hunt for pleasure only as they do not eat the flesh but in the case of absolute necessity..."

Two days later bears were again his topic:

> "...Saturday 17th. The Indians having hunted yesterday we did not rise the Camp but remained here all day. There were many Bears

> here about, who are attracted by the quantities of Choak Cherries and other fruit there is here..."

He commented briefly before he left the Tongue River on the clear cold water in the small streams in the upper reaches of the Tongue. On his return home along the Yellowstone River he crossed the Tongue again.

Captain Raynolds entered the basin at its north end. On August 5, 1859, the Raynold Expedition fished in the Tongue:

> "...After encamping, some of the party succeeded in catching several very fine catfish over 18 inches long, furnishing an agreeable variety in our monotonous bill of fare..."

Just before leaving the Tongue River drainage on August 8:

> "...A magnificent buck elk was shot just after encampment, being the first of that species of game yet seen. His horns were about four feet long, and still in velvet..."

As the Raynolds party passed out of the Tongue River on August 9 an enormous grizzly bear and her cubs were in the stunted pines on the divide. Later, on September 12, about to reenter the Tongue drainage, bears were as common as they were in Larocque's time half a century before:

> "...Bears are very numerous, more than a dozen having been seen in the course of the day's march, and one, a yearling cub, was brought down by Bridger's rifle. Elk, deer, and antelope have also been seen in abundance, and we can now understand why the Indians cling with such tenacity to their country. No buffalo have been seen to-day, but the number of skeletons visible upon all sides show that at times they are to be found here in large numbers..."

Certain big game species increase with cuts in numbers of competing big game. For example, pronghorn antelope were not mentioned in Wyoming in 1812 on the very ranges where they now form the largest concentrations in the world. Their absence from the plains then was accented by the exceptional abundance of other game - which included even bighorn sheep.

Cattle and sheep have replaced the elk, the buffalo, and the bighorn on the breaks and plains of the Tongue River. But forage and cover unsuited to livestock produces large numbers of deer and antelope, perhaps not overly much below those of earlier times.

The basis for recreational big game hunting now lies with mule deer, whitetail deer and antelope on the plains, and elk and mule deer in the mountains.

Hunters may have to be satisfied with less trophies and shorter hunting seasons, but with this adjustment the Tongue River Area big game population is capable of supporting future recreational use.

The changes in the Tongue River wildlife extends to the badgers, the coyotes and foxes. These seem to be in much fewer numbers because of predator controls. An increase in racoon, skunk and opossum is evident. The increase in number of certain big game and smaller mammals may be those that survive best in changes brought about by man.

Hunting pressure certainly was the most important single action in the elimination of certain big game species. Reintroduction of formerly successful big game animals such as moose and bighorn sheep has met with little success. But as years go by game management may be able to reestablish certain big game species in parts of the Tongue River Basin where now only the record shows they were ever there.

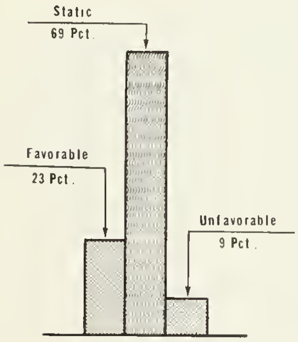
PHOTOGRAPHIC COMPARISONS FOR TREND
Missouri River Basin and Tongue River Area

The Missouri River Basin Group of the Bureau of Land Management now has about 150 pairs of photographs, the originals date from 1870 to about 1930, the time spanned varies from 35 to 97 years. Thus far plains, deserts and mountains in southern Wyoming and southeastern Montana are included. One hundred of these photographic pairs and sixty-eight of the photographs taken by Phillips and Shantz for Report 214 University of Arizona, "Vegetational Changes in the Northern Great Plains", were evaluated in an effort to discern a general trend in the Missouri River Basin to compare it with the Tongue River subbasin.

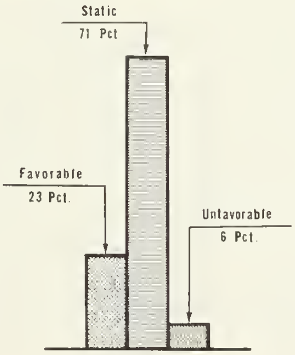
Photographs have limitations. Grasses are difficult to identify. Early in the year annuals may obscure perennials; late in the year grazing may make identification difficult. Photographs often will be changed by new roads, expansion of townsites, and cultivation.

Erosion can easily be evaluated, trees identified, and the pattern of establishment of shrubs is easily seen as the ground cover of grasses and forbs presents no difficulty. Determining the trend of vegetation, woody plants and other perennials may be easy for one species and difficult for another because foreground and background may vary in seasons of the year.

Overall, photographs lend themselves well to generalization and surprisingly specific conclusions.



Missouri River Basin
Figure 39a



Tongue River Area
Figure 39b

Trends in Range Condition and Cover

Changes in vegetation for the Missouri River Basin's 168 photographic pairs reveal a favorable trend in 23 percent; 69 percent remain essentially static; and 9 percent show an unfavorable trend. This same general percentage of range condition and trend in the Tongue River Area as compared with Missouri River Basin is seen in Figures 39a and 39b.

TRENDS IN TIMBER COVER

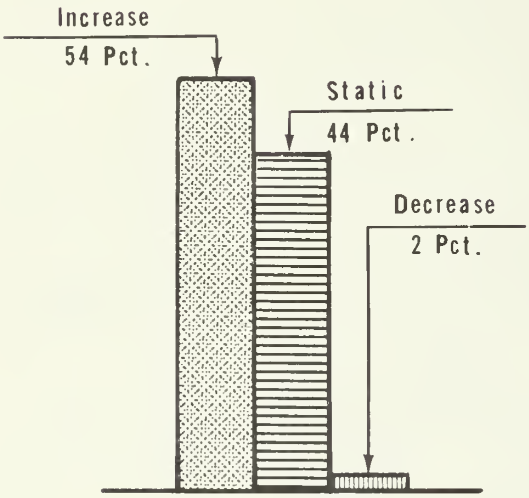


Figure 40a
Missouri River Basin

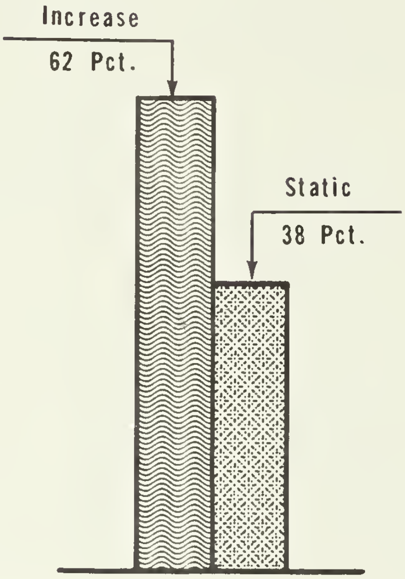


Figure 40b
Tongue River Area

Photographic pairs in the Northern Great Plains show a surprising favorable trend in tree cover. Timber increased - the number of trees occupying new areas and the annual increment of growth represents a break with the past of both the Missouri River Basin and Tongue River Area. The Missouri River Basin's 168 pairs of photographs show an increase in ground cover and growth in 54 percent; 44 percent with increase in size but not in area; and but 2 percent with a downward trend. The Tongue River Area by comparison has a considerably higher trend in the increase of timber and there is no decrease corresponding to the small percent decrease in the Missouri River Basin. The difference is not surprising as the Missouri River Basin photographs include the plains of Nebraska, and North and South Dakota.

TRENDS IN ACCELERATED EROSION

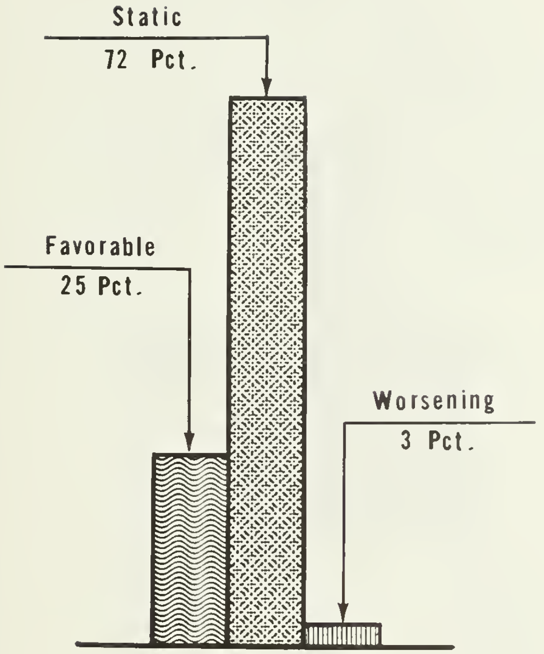


Figure 41a
Missouri River Basin

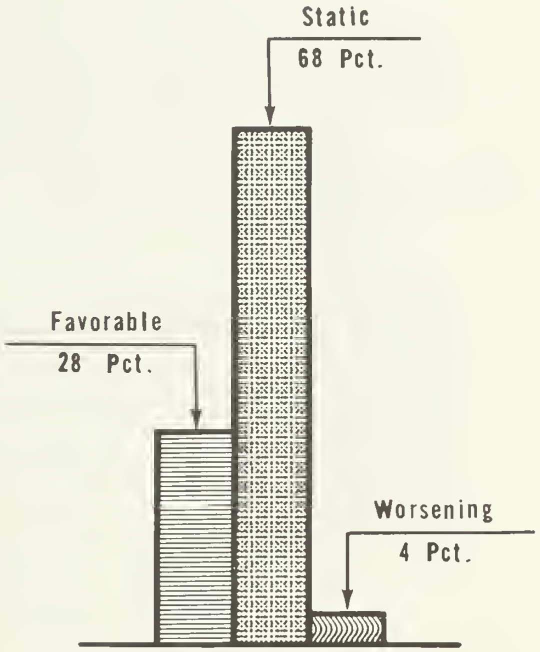


Figure 41b
Tongue River Area

Accelerated soil erosion rates for both wind and water are combined in figures 41a and 41b. This is to simplify presentation. For the Missouri River Basin with 168 pairs of photographs a favorable trend is revealed in comparisons on 25 percent of the photographs which have lessened rates of erosion. Seventy-two percent show no change, in that most are stabilized, and but 3 percent had photographic pairs indicating an increase in the rate of soil loss. The Tongue River Area has much the same erosion pattern as that of the Missouri River Basin. However, as can be seen in comparison Tongue River has 4 percent (1 percent higher) on which erosion rates are increasing. This may be due in part to a disproportionate percentage of photographs of the badlands in the Tongue River Area.

OVERALL TREND

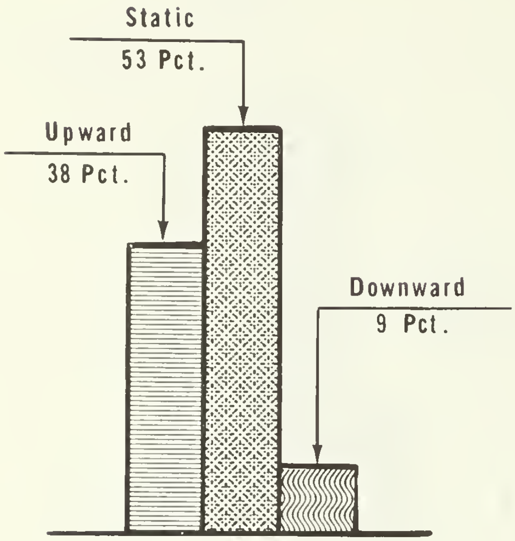


Figure 42a
Missouri River Basin

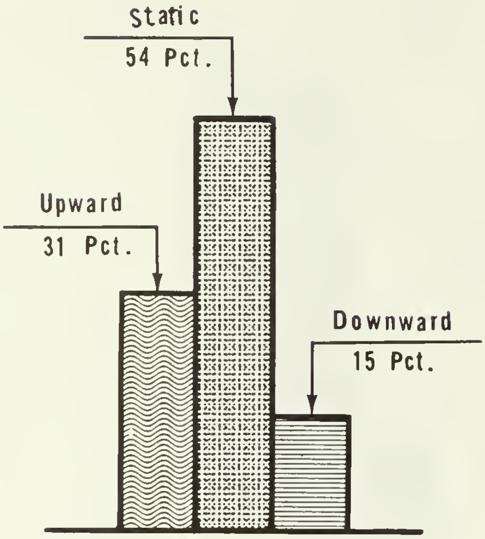


Figure 42b
Tongue River Area

The overall trend, which includes all plant cover, range condition, and erosion shows a definite improvement on Missouri River Basin for 38 percent of the pairs; 53 percent remain static and 9 percent show a definite drop.

The Missouri River Basin compared with the Tongue shows a dominance of unchanging conditions in both areas with but one percentage point difference between them. However, the percentage of the downward trend in the Tongue is six percent greater than that of the Missouri River Basin. This is undoubtedly attributable to the greater percentage of badlands in the Tongue's photographs.

The photographs which follow are like those illustrations in the main text. The location and years in which the photographs were made establish the time span in the comparisons. The Geological Survey photographs are uppermost, the Bureau of Land Management photographs are those below.

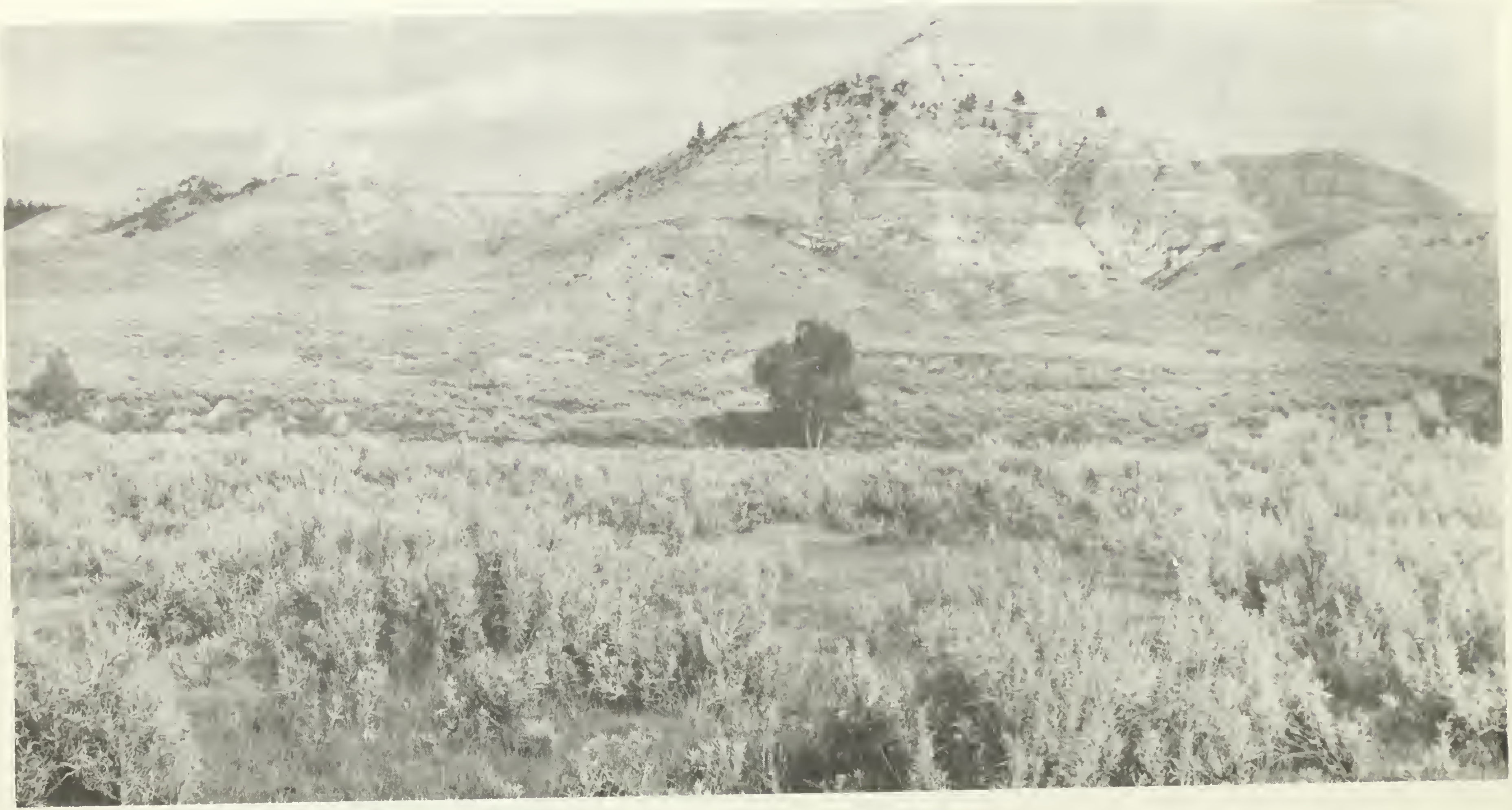
Fifteen Photographic Pairs Comparing Changes In Range, Timber, Erosion and Culture On The Tongue River.

(Time span from 38 to 65 years)

Early photographs sampling timber, rangeland, soil erosion and economic developments are usually chosen from among the 140,000 photographs available at the Department of the Interior, U. S. Geological Survey Photo Library in Building 25 at the Denver Federal Center, Denver, Colorado 80225. The following photographs are from that source:

Figure 43	upper	Collier U. S. G. S. File No. 540	1907*
Figure 44	upper	Collier U. S. G. S. File No. 54	1907
Figure 45	upper	Baker U. S. G. S. File No. 66	1924
Figure 46	upper	Baker U. S. G. S. File No. 25	1924
Figure 47	upper	Collier U. S. G. S. File No. 503	1907
Figure 48	upper	Baker U. S. G. S. File No. 53	1924
Figure 49	upper	Collier U. S. G. S. File No. 514	1907
Figure 50	upper	Collier U. S. G. S. File No. 527	1907
Figure 51	upper	Collier U. S. G. S. File No. 518	1907
Figure 52	upper	Collier U. S. G. S. File No. 526	1907
Figure 53	upper	Baker U. S. G. S. File No. 28	1924
Figure 54	upper	Baker U. S. G. S. File No. 86	1925
Figure 55	upper	Collier U. S. G. S. File No. 519	1907
Figure 56	upper	Collier U. S. G. S. File No. 541	1907
Figure 57	upper	Baker U. S. G. S. File No. 14	1924

* Note: 1907 on Colliers photographs is the date of publication of his report. The actual photography varied from four to six years earlier. A time span of 55 years based on his 1907 date is more likely a comparison of a 60 year time span.



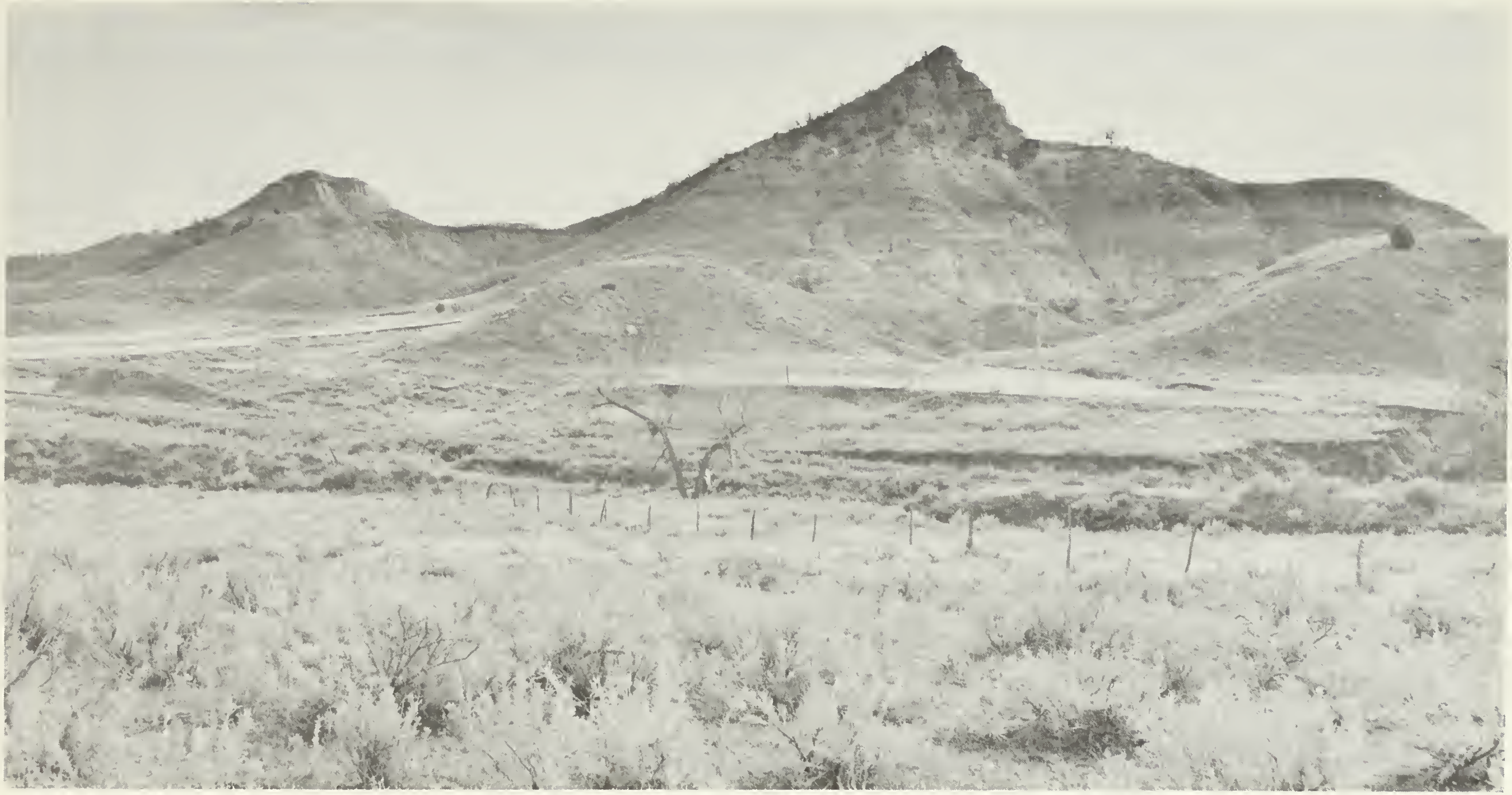
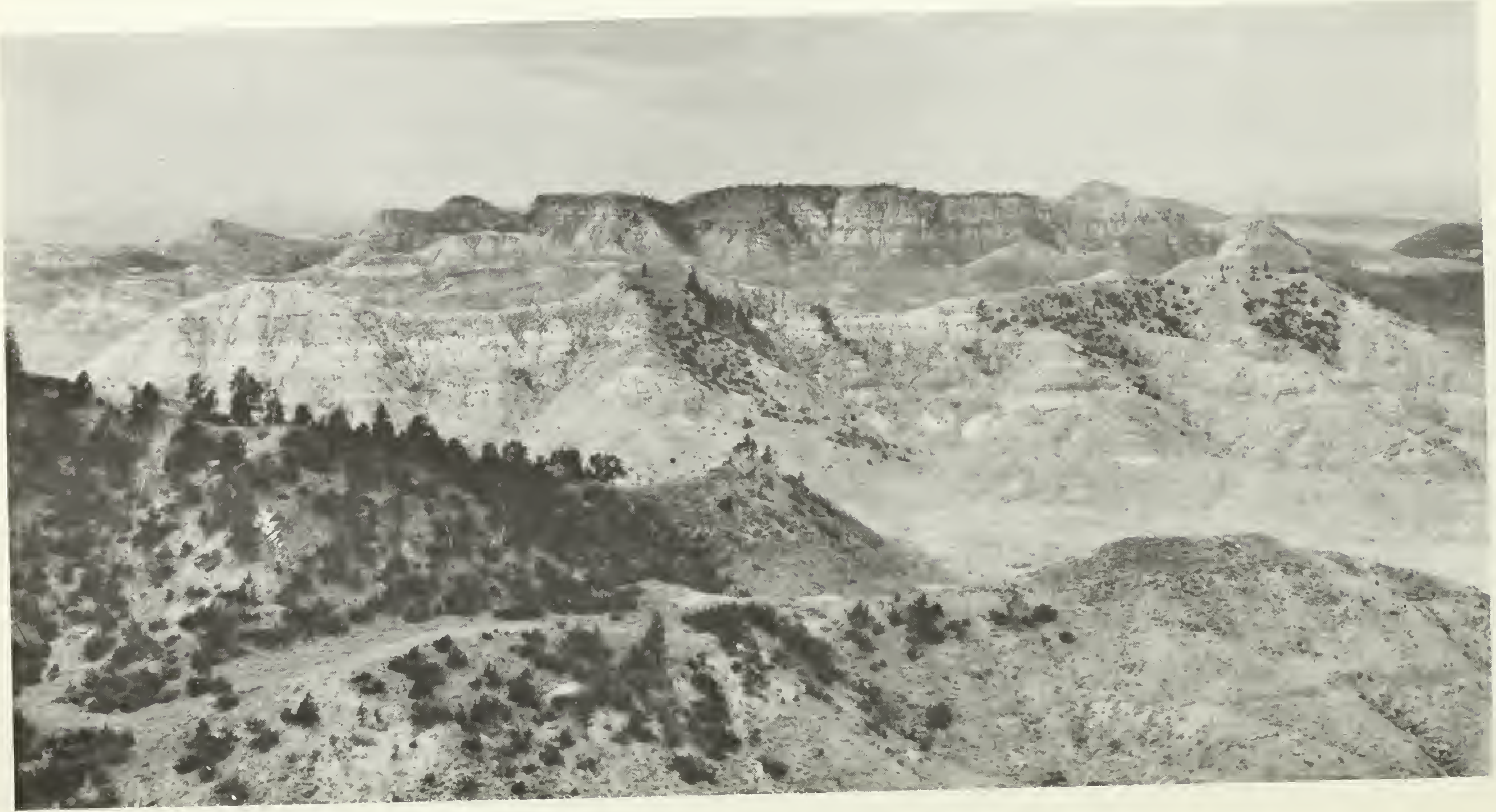


Figure 43   Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years.
Location southeast of Miles City, Montana lower Tongue River Basin.
The 1962 photograph is grazed pasture in late November. Silver sagebrush density diminished. Grass cover unchanged. Apparent erosion in mid-distance (1962) is a new road to a ford on the creek. The tree in mid-center is dormant. River banks have heavier vegetation and are stabilizing. Erosion, ground cover, and range condition seem essentially stable.



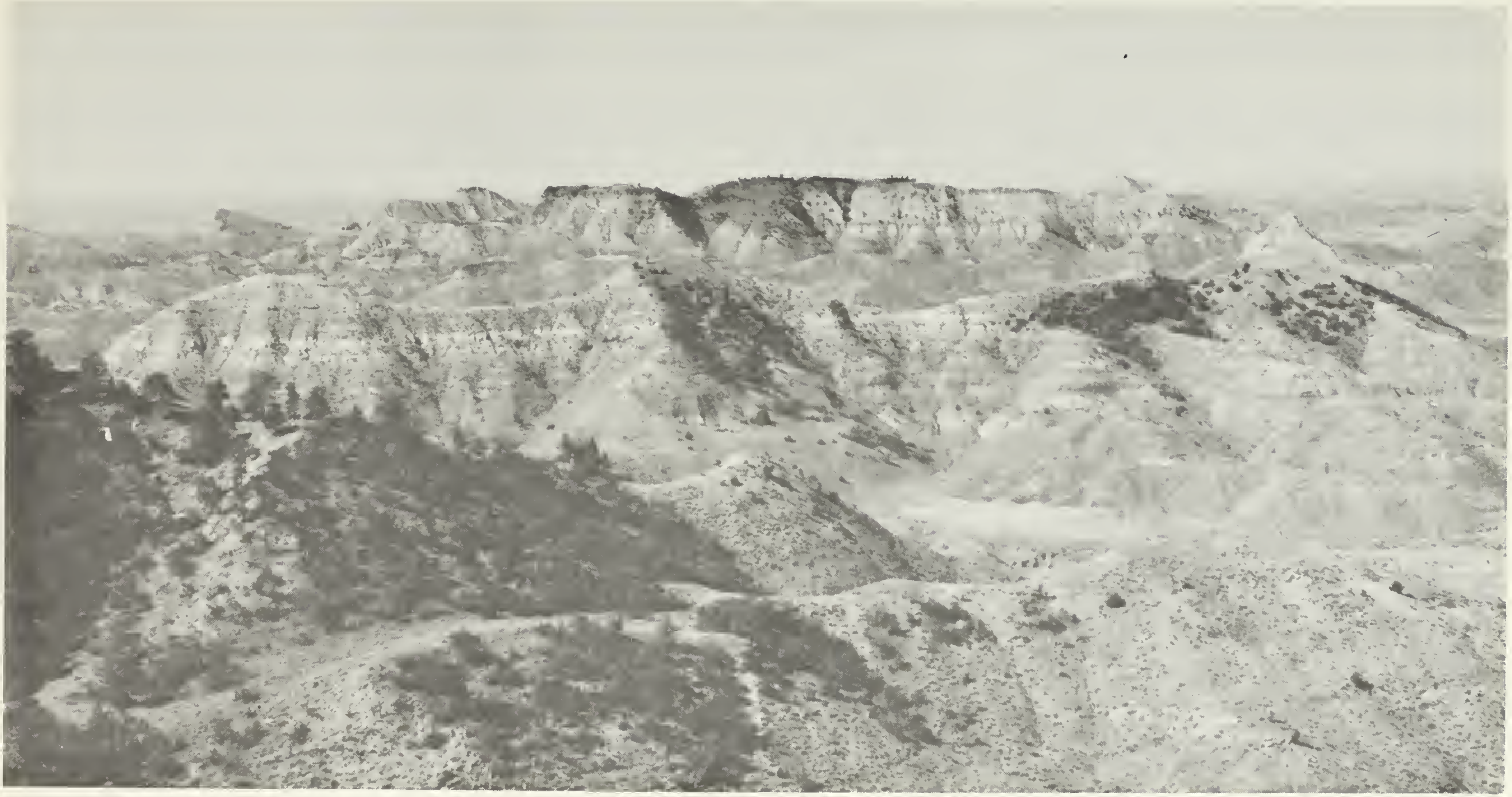


Figure 44 Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years. The rugged country southeast of Miles City, Montana in the lower Tongue River basin shows relative stability. Ground cover and density of timber has increased, especially on the hills in the foreground and mid-distance. A large gully (below the large canyon in the center) has not extended. Vegetation is vigorous with adequate ground cover. A favorable trend in both erosion condition and timber is seen.

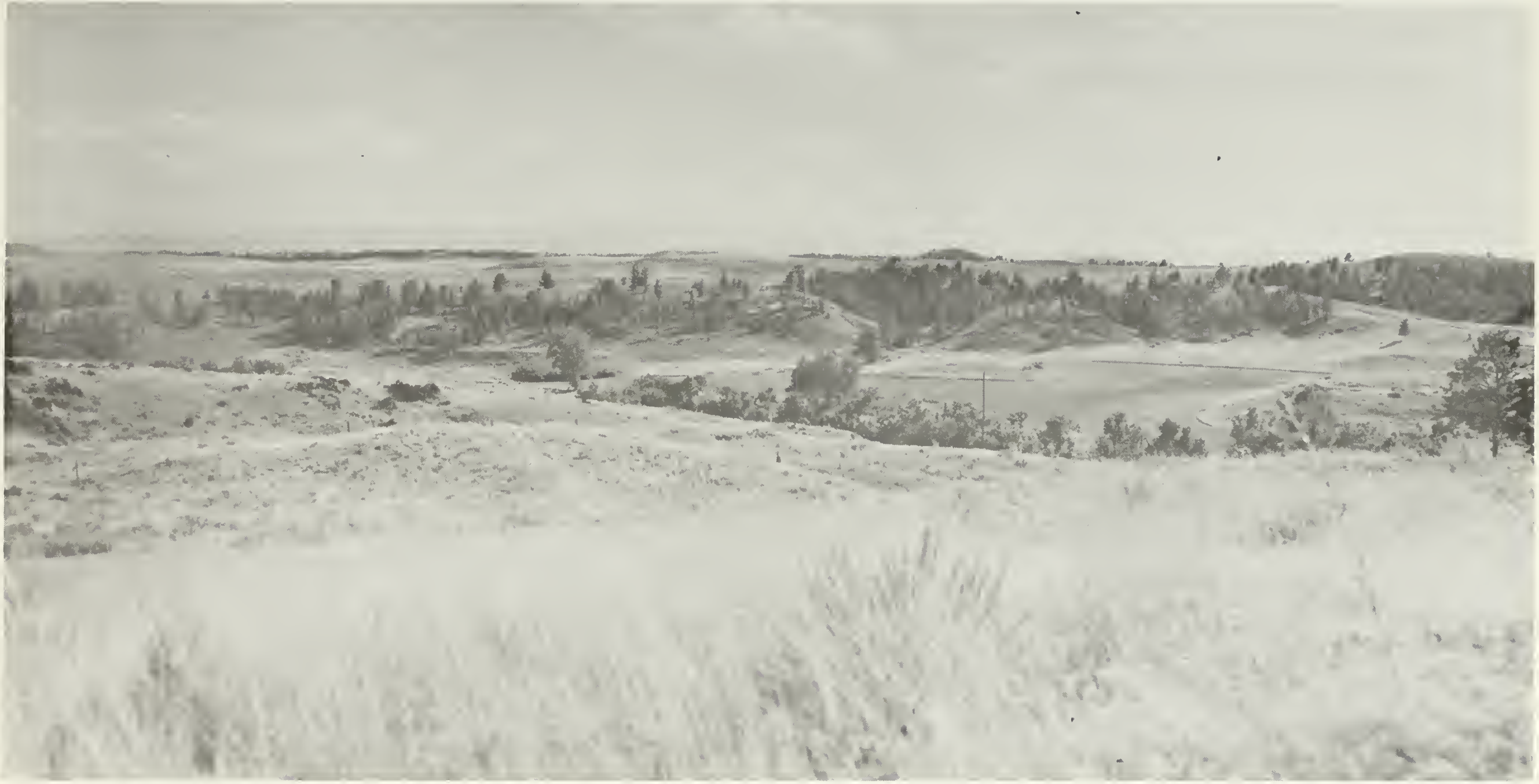
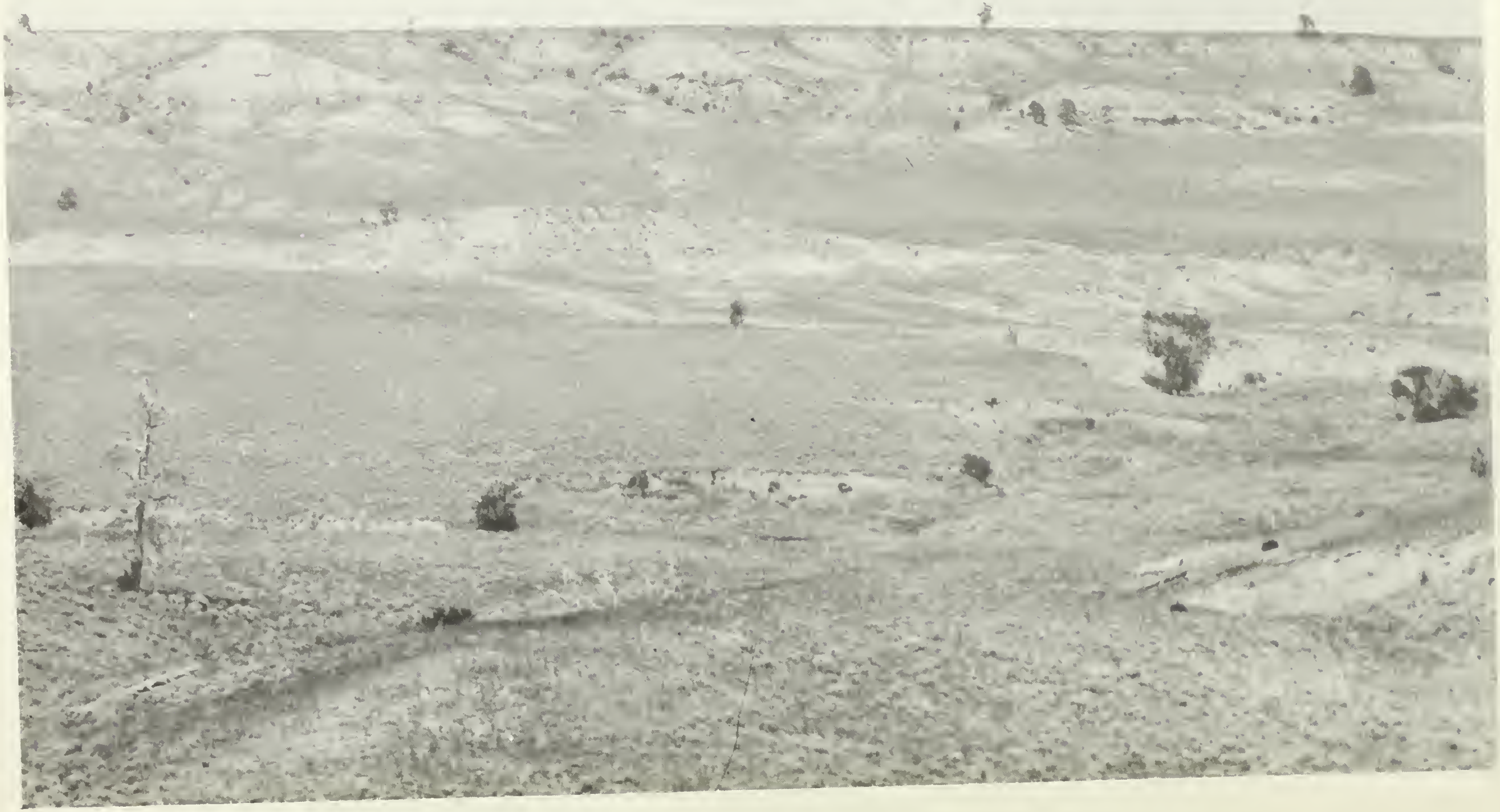


Figure 45 Top photo Baker, 1924. Bottom photo BLM, 1962. Time span 38 years.
Close to the Montana-Wyoming border in the Upper Tongue River Basin.
Change evident in both range vegetation and timber. Range vegetation (foreground) is dropping in condition; sagebrush has decreased, many annual plants are apparent, and yucca has invaded. Timber on the ridge in the background has increased markedly in size and somewhat in area.



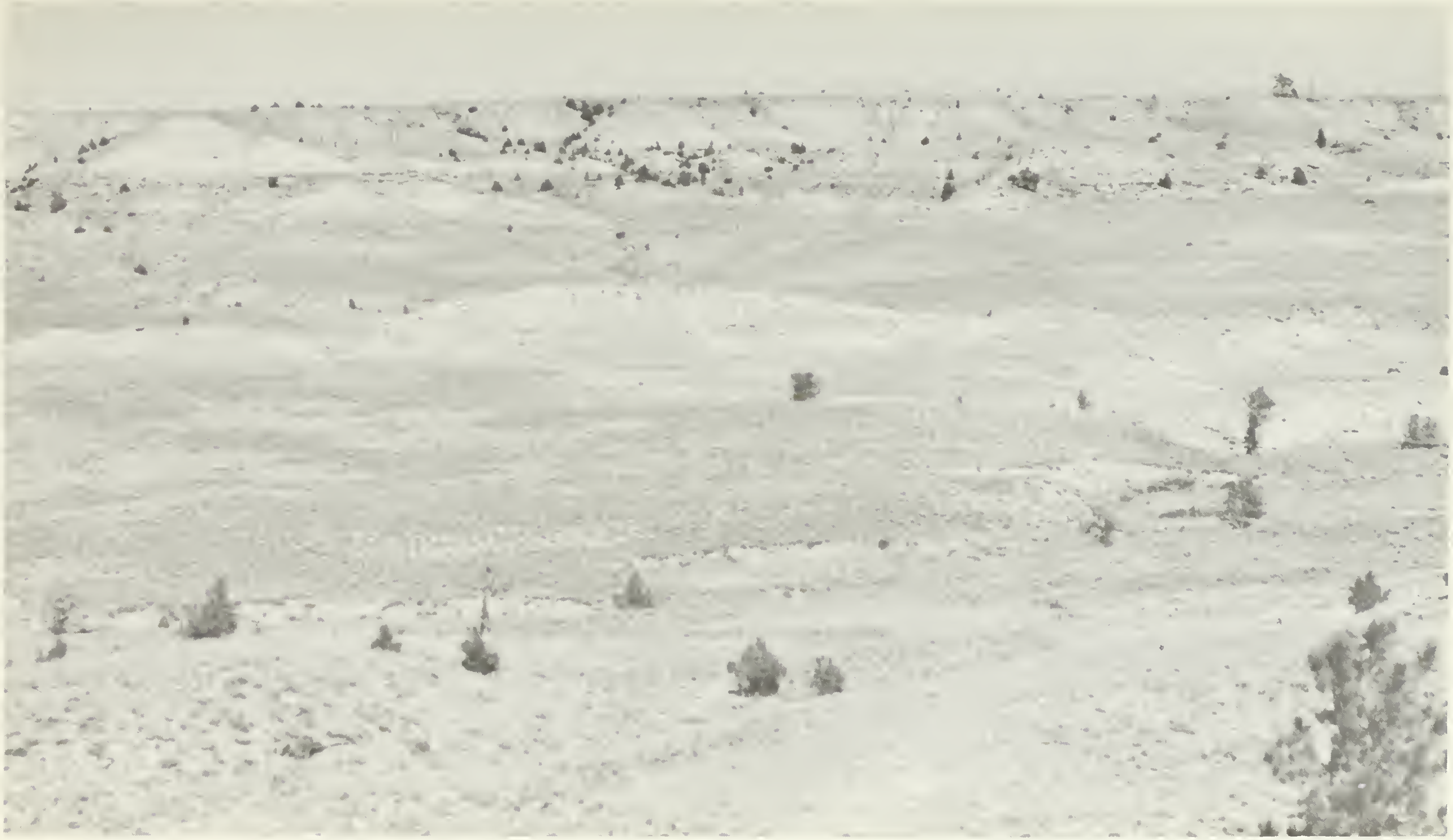
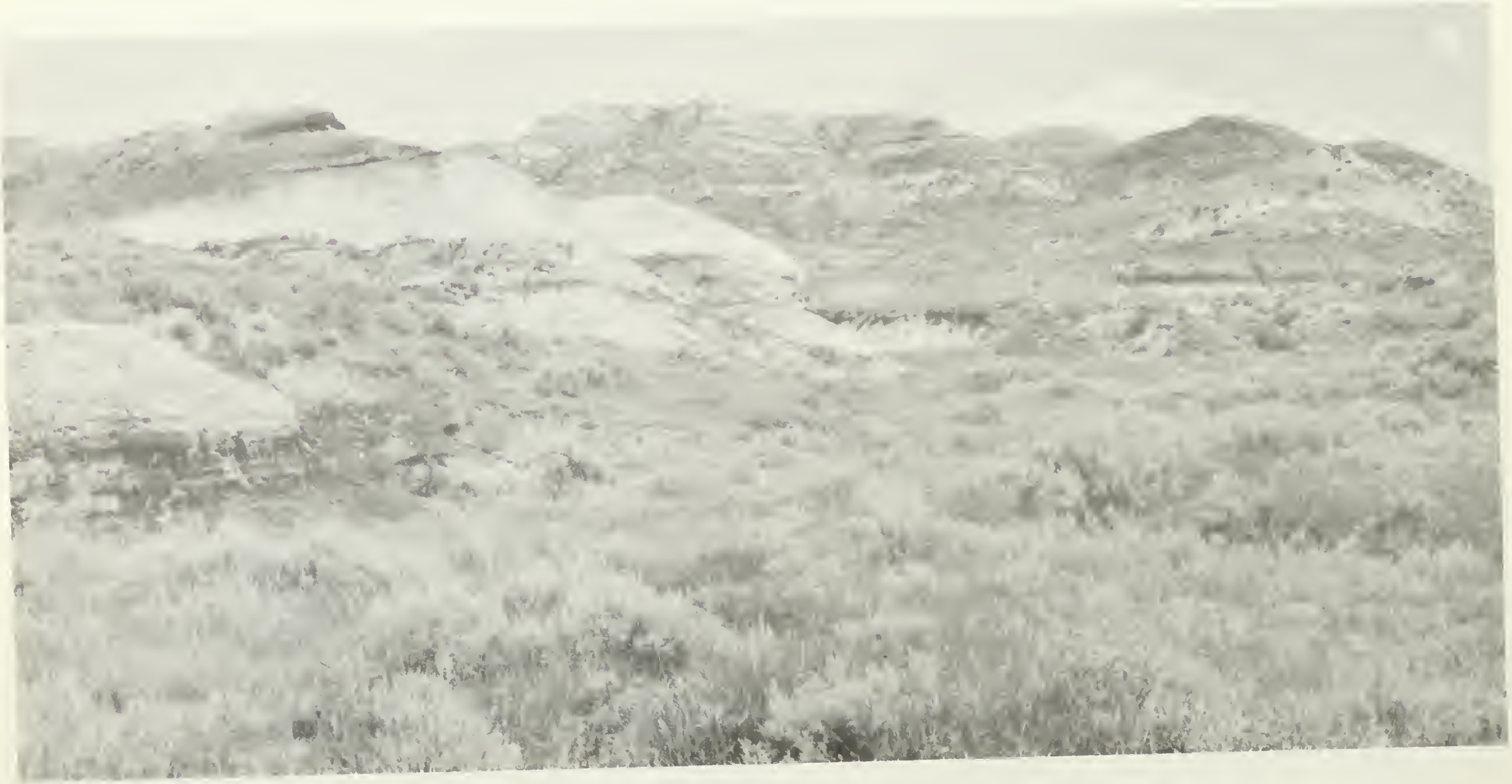


Figure 46 Top photo Baker, 1926. Bottom photo BLM, 1962. Time span 38 years.
The relatively level country of the Tongue River, before it drops to the broken country of mid-basin, has changed little. Vegetation and erosion seem stable.



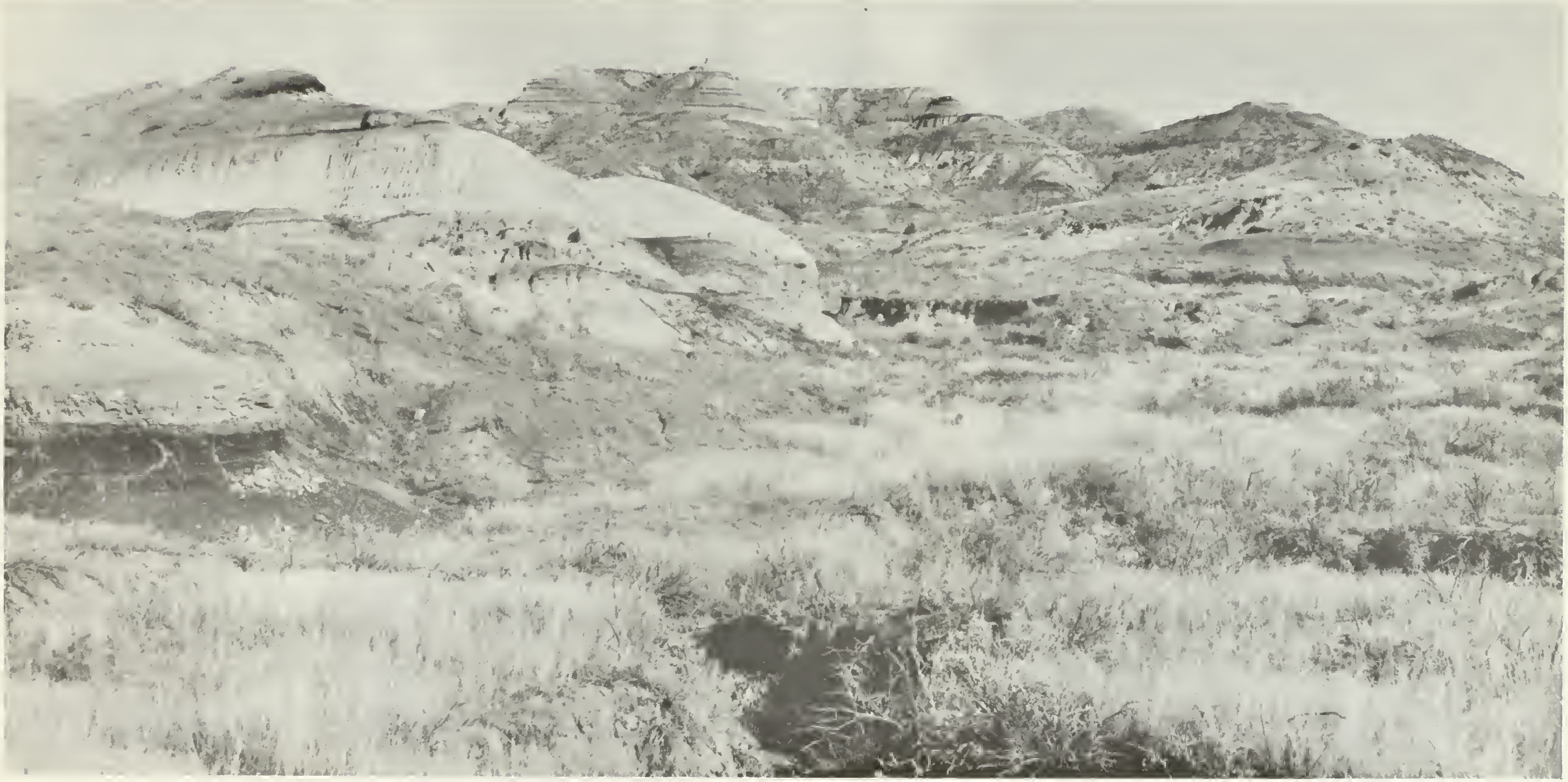


Figure 47 Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years.
Badlands, lower Tongue River Basin southeast of Miles City, Montana.
(1962 photograph taken about 12 feet from the original.) In the foreground silver sagebrush has disappeared, western wheatgrass has decreased to be replaced in part by annuals. The slopes on the left have dead shrubs in 1962, ground cover has greatly decreased and erosion increased. Geologic erosion aggravates the problem of accelerated erosion and water quality.

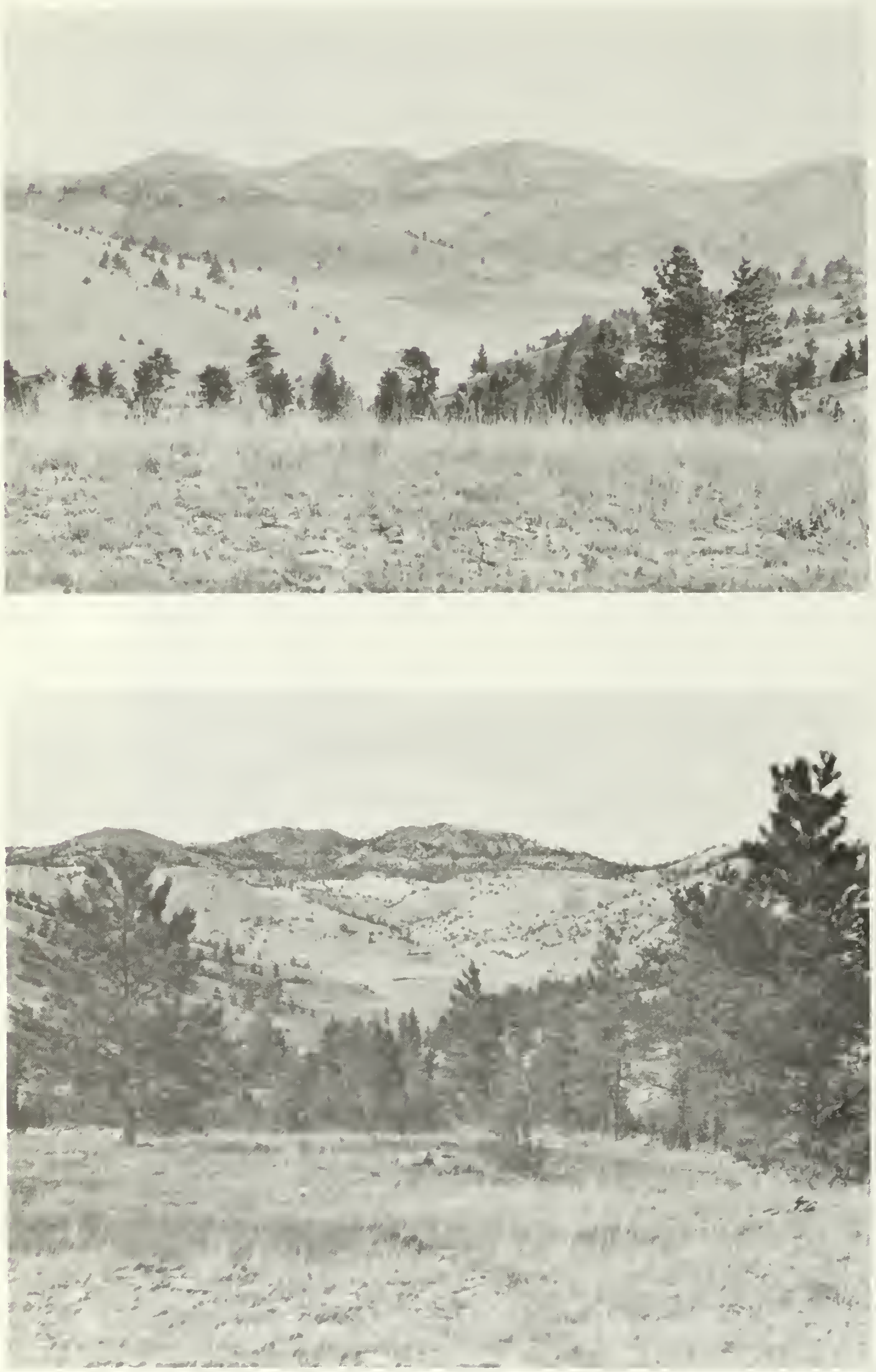
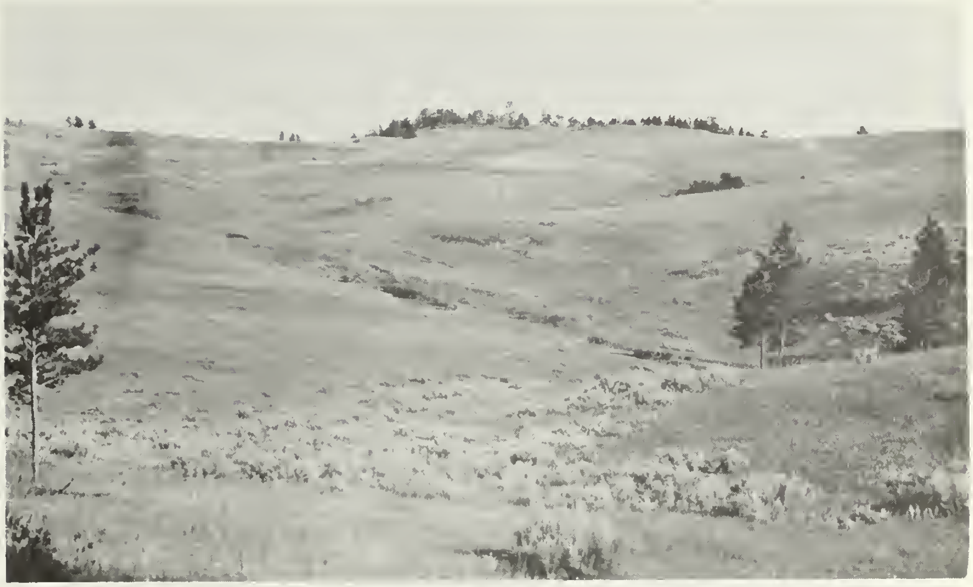


Figure 48 Top photo Baker, 1924. Bottom photo, BLM 1961.
Time span 37 years.

The broken country in mid-basin. The size and density of tree cover has increased, otherwise the area seems unchanged. Erosion in an intermittent streams and the gully in the middle of a cultivated field show no signs of enlargement although they are more apparent in the 1962 photograph due to better photographic techniques. In the foreground the range condition has not changed although prairie sandreed grass is less evident at the time of the followup photo than in the original.



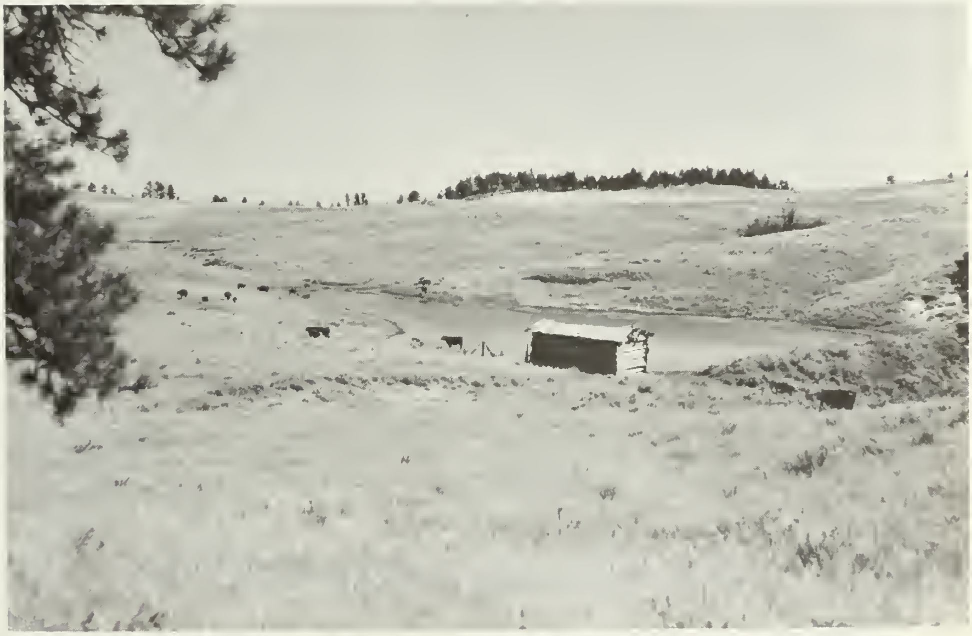
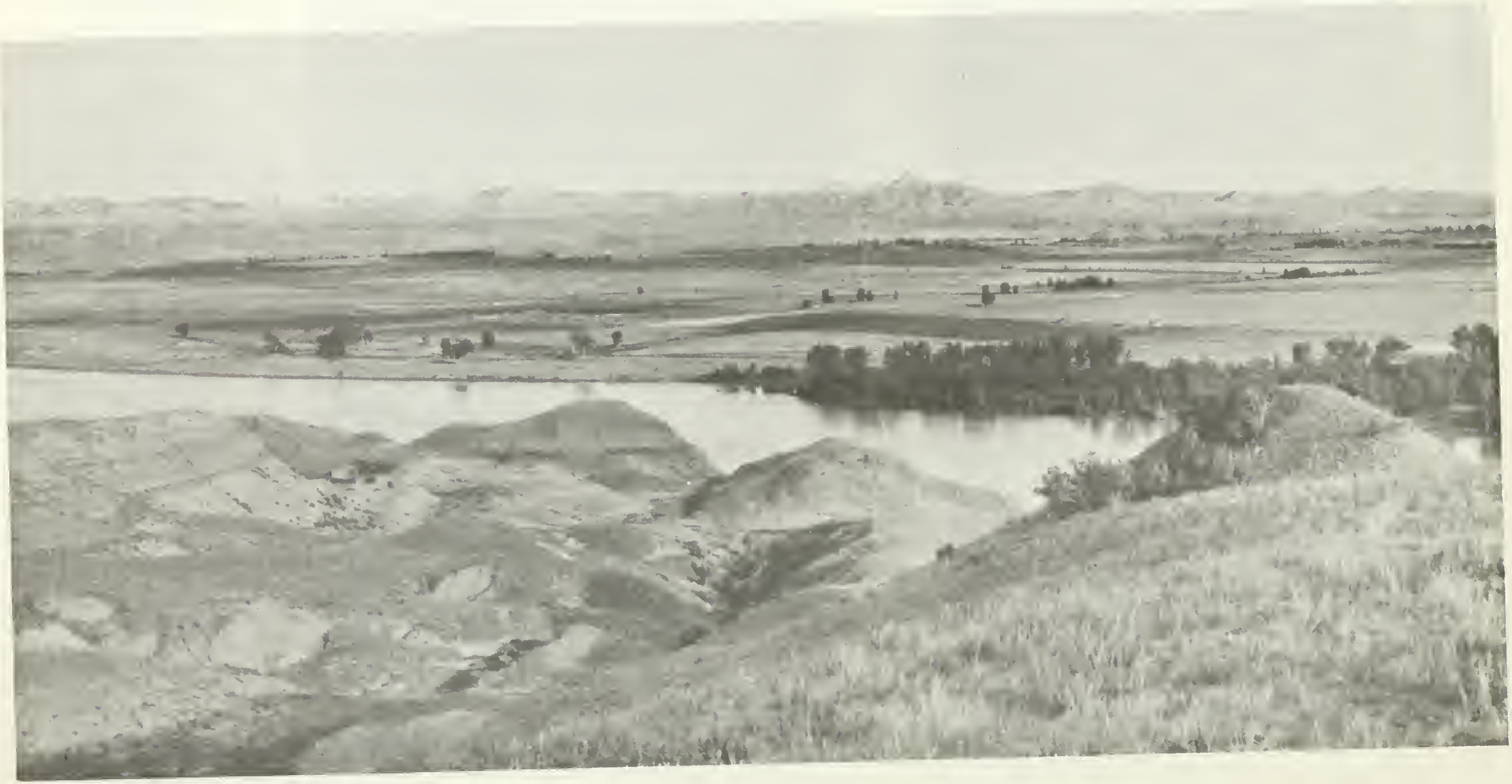


Figure 49 Top photo Collier, 1907. Bottom photo BLM, 1962
Time span 55 years.
This comparison pair lie on the rim southeast of Miles City, Montana in the Tongue River Basin. The tree cover increase in the distance is extensive, the dam in the foreground destroyed some of the sagebrush. A vaguely defined slope in mid-distance has almost completely revegetated on its patches of raw soil. Erosion rates throughout the 1962 photograph seem unchanged.



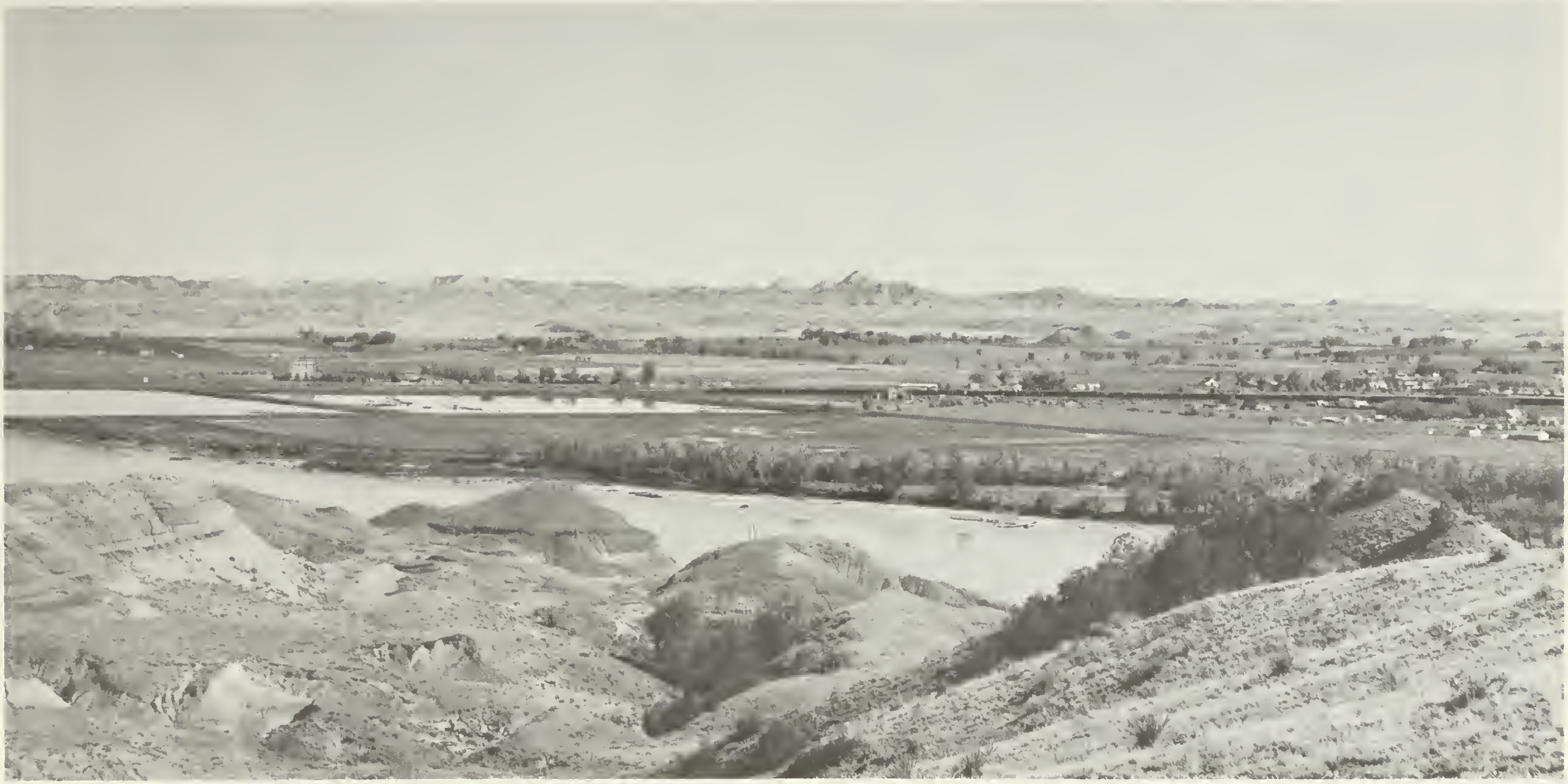
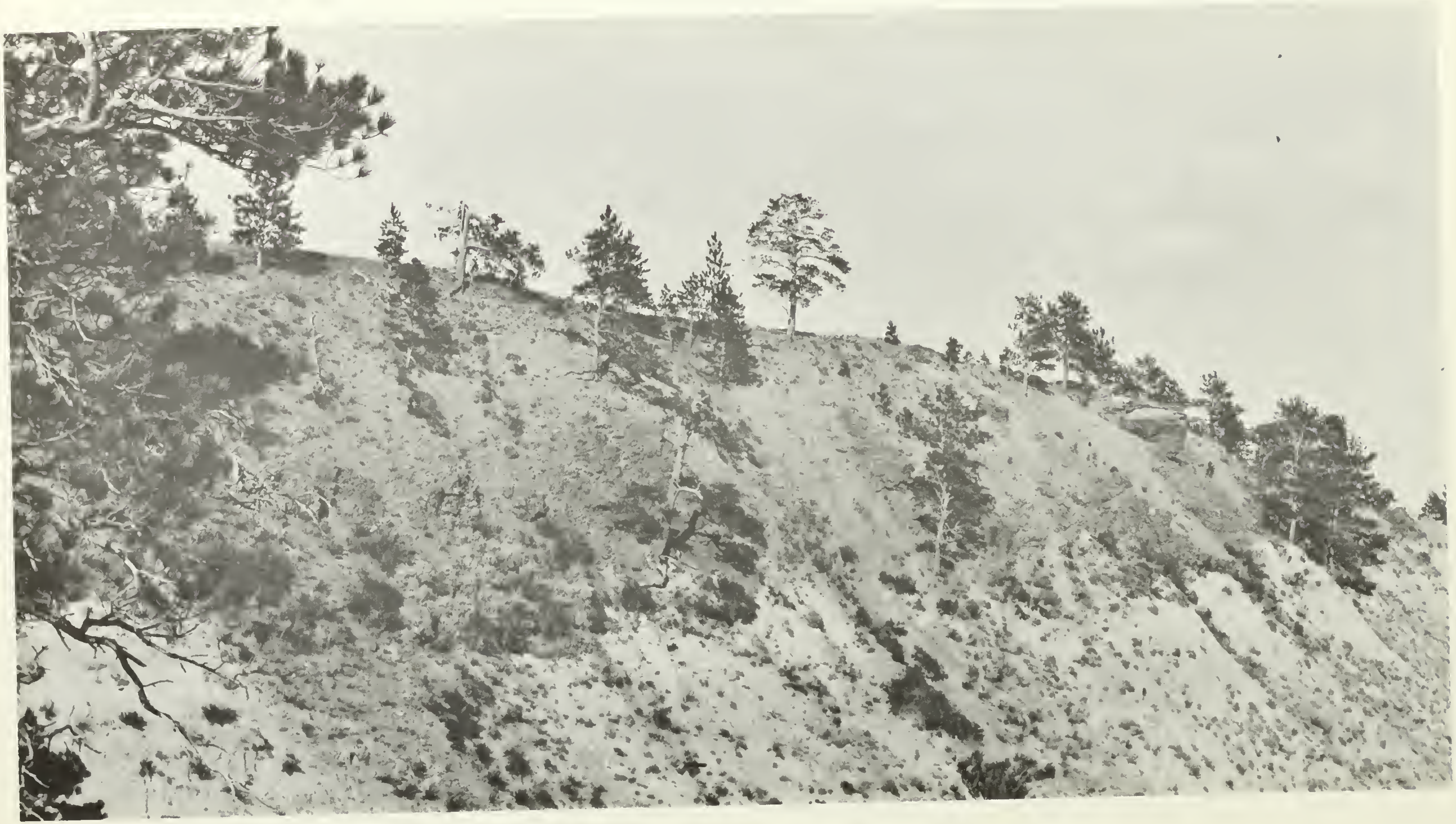


Figure 50 Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years. Clays and gravelly terraces north of Miles City, Montana in the fall. Grazed range. Gulley cuts remain unchanged, erosion is proceeding at an extremely slow rate. Raw soils around 1907 have been vegetated to grass. On the gravelly soils junipers have spread and yucca has invaded but green sagebrush has disappeared. The grasses on the gravelly terraces are dominated by needleandthread in both photographs. Grazing may have created an impression of a change in range condition, change is definite but the condition appears relatively the same.



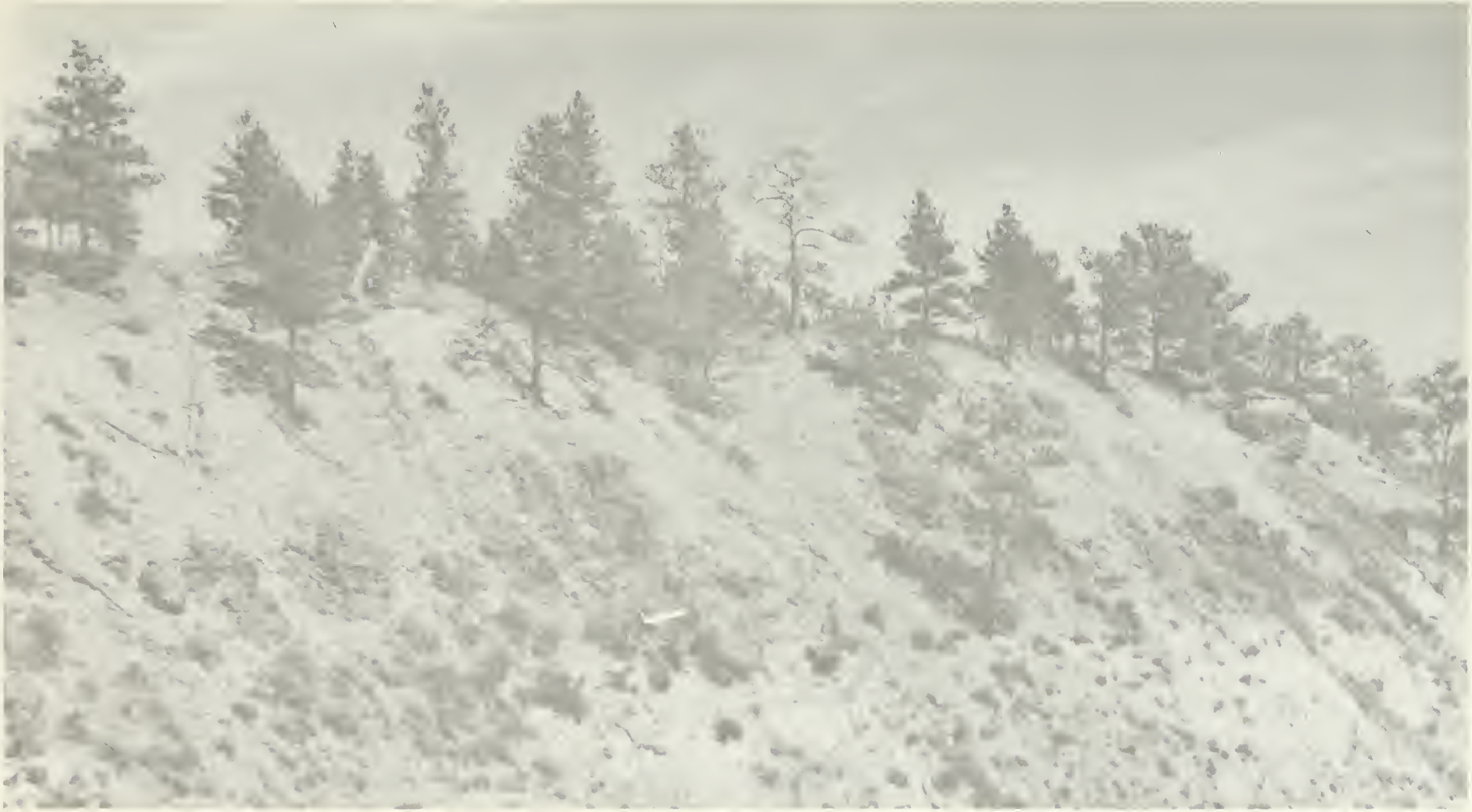
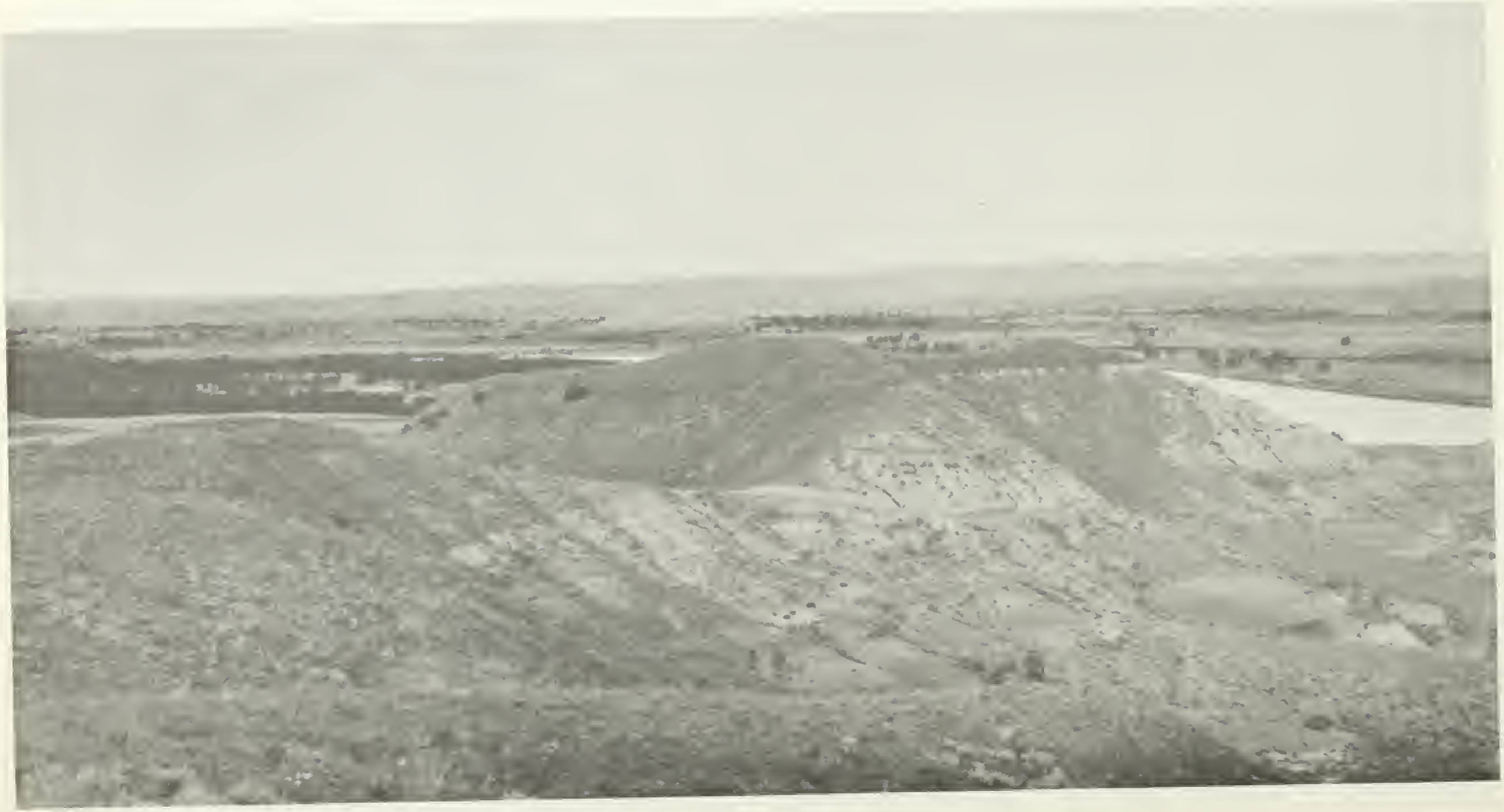


Figure 51 Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years. Rough, broken country close to Miles City, Montana. Trees have grown in size and increased their occupancy along the ridge. A line of contact marked by boulders of scoria slag from burned coal beds is apparent. Along this line mountain mahogany has increased a little. Erosion seems much the same.



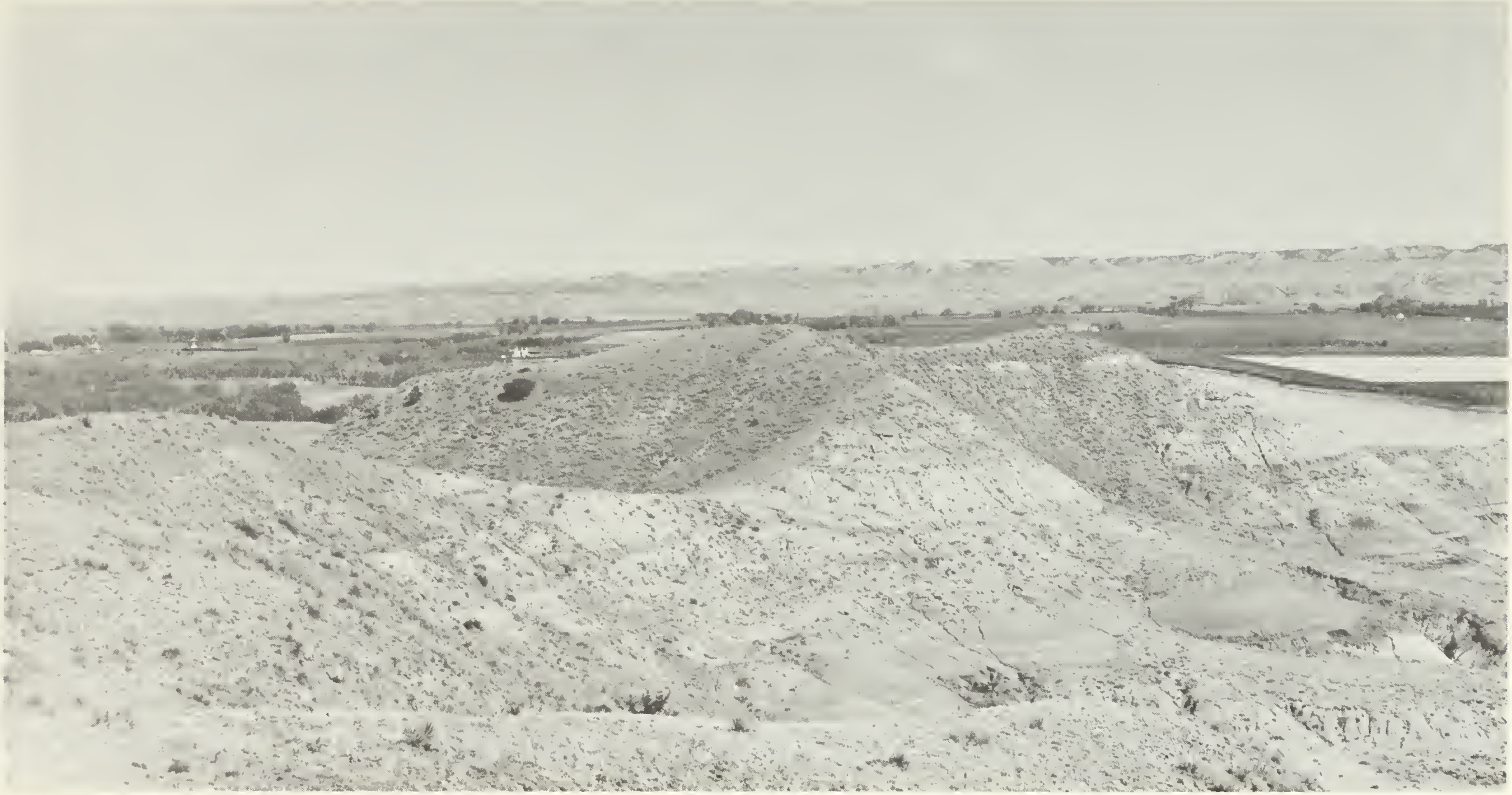
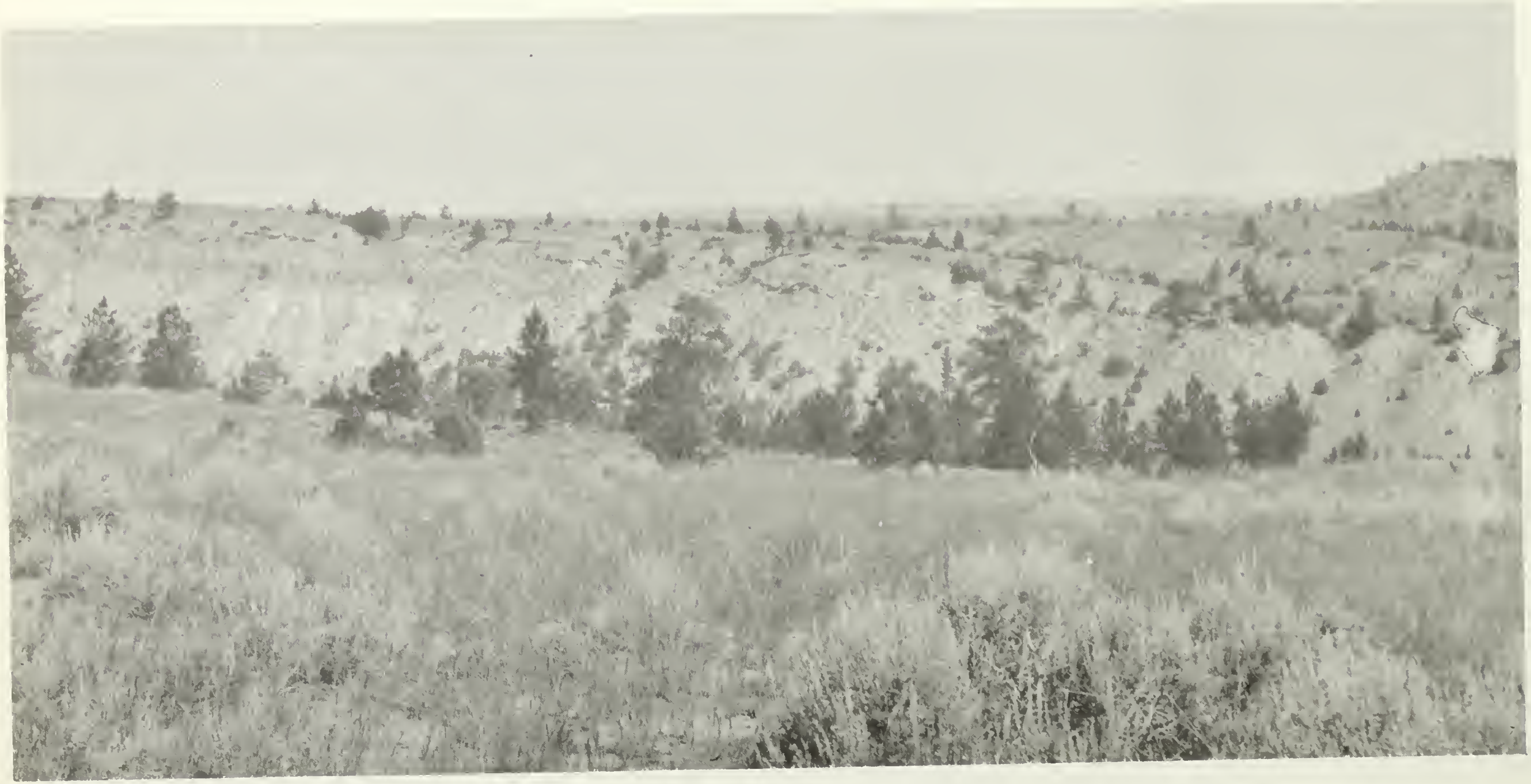


Figure 52 Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years. Clay and gravel terraces north of Miles City, Montana. Of greatest interest is the relative stability of erosion of the gullies. Vegetative cover has increased on the shallow soils and is very slowly invading the raw soils. Winterfat, in the foreground in 1907, is not apparent in 1962 - however, it was present but heavily grazed. Range condition is much the same.



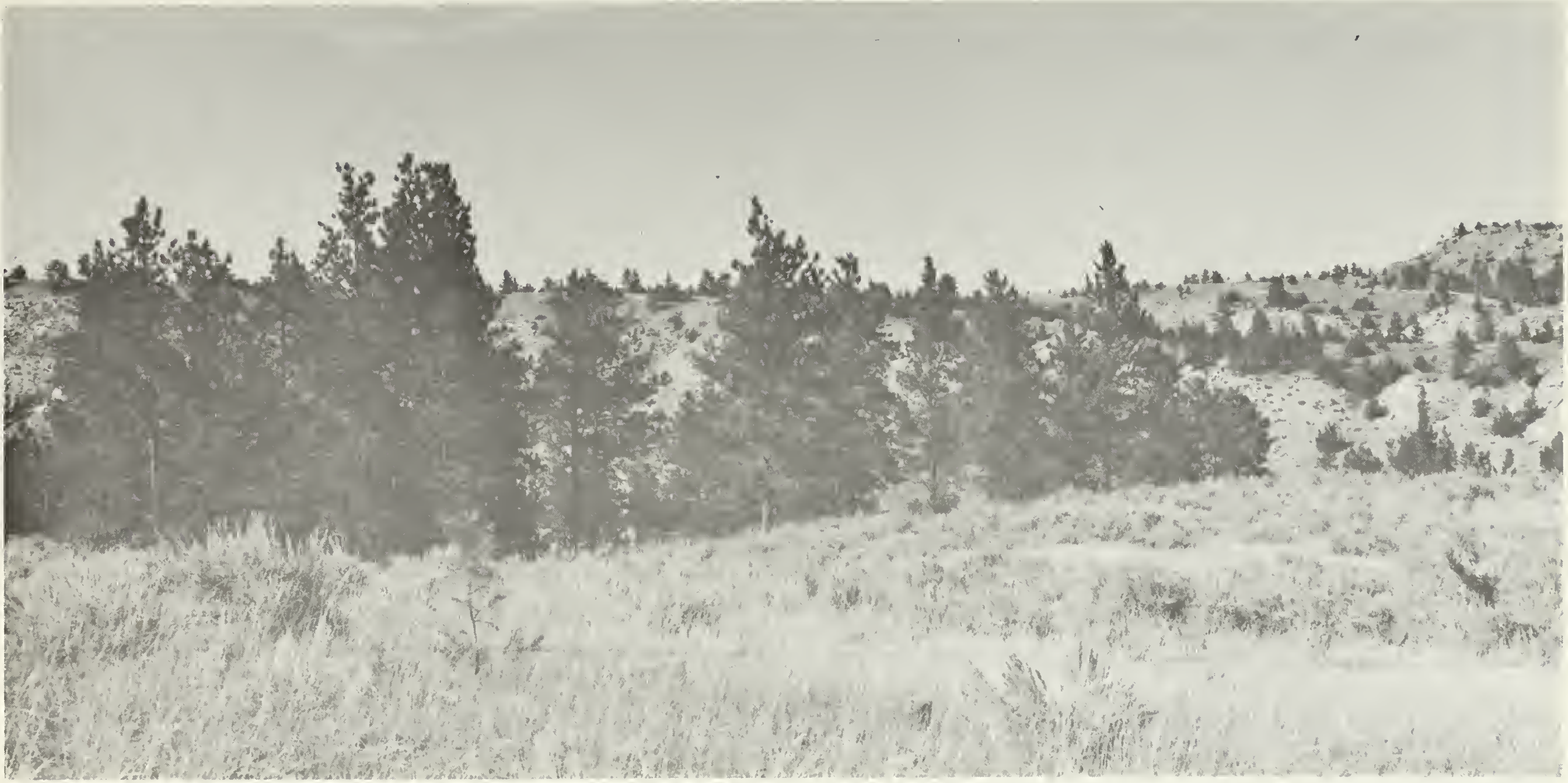
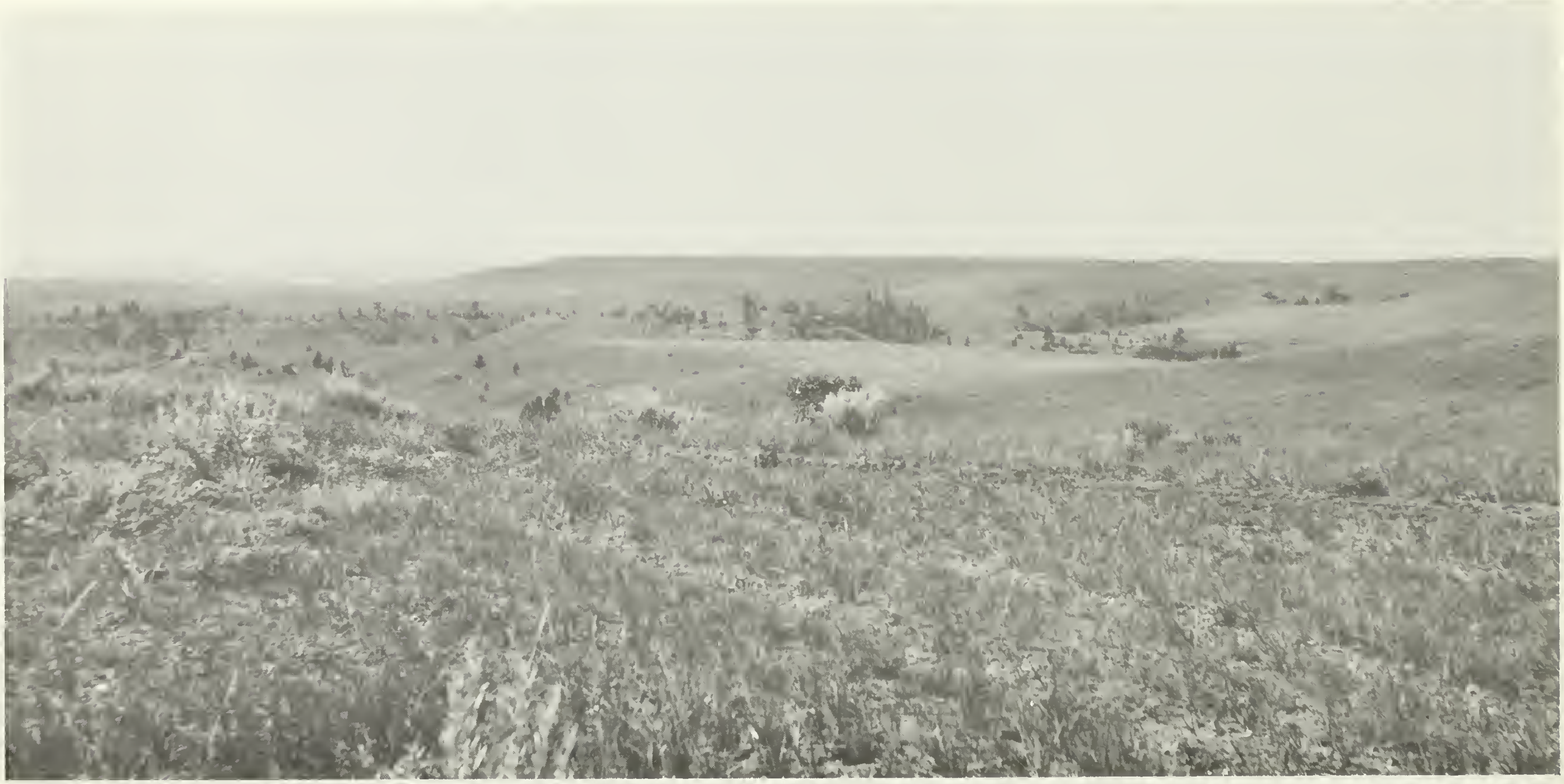


Figure 53 Top photo Baker, 1924. Bottom photo BLM, 1962. Time span 38 years.
Public domain in the rugged country of mid-basin. Evident increase in timber cover on all the slopes visible in the photographs; not only in size but numbers of trees have increased.
The vegetation in the foregound seems relatively stable. Sagebrush has not changed in numbers or location. The heavy growth of trees in the foreground made exact location impossible. However, relocation is within a probable 200 feet of the original.



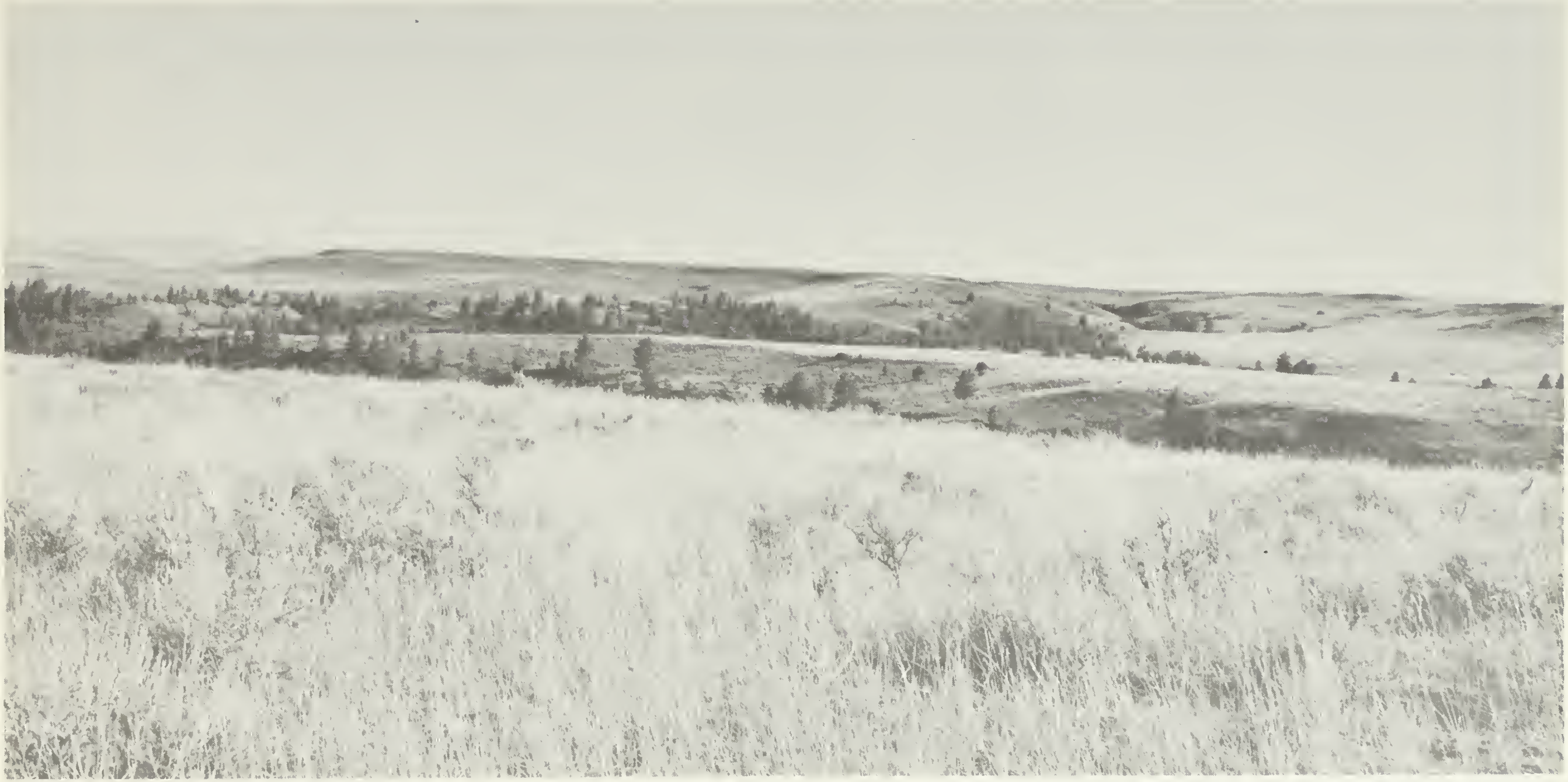
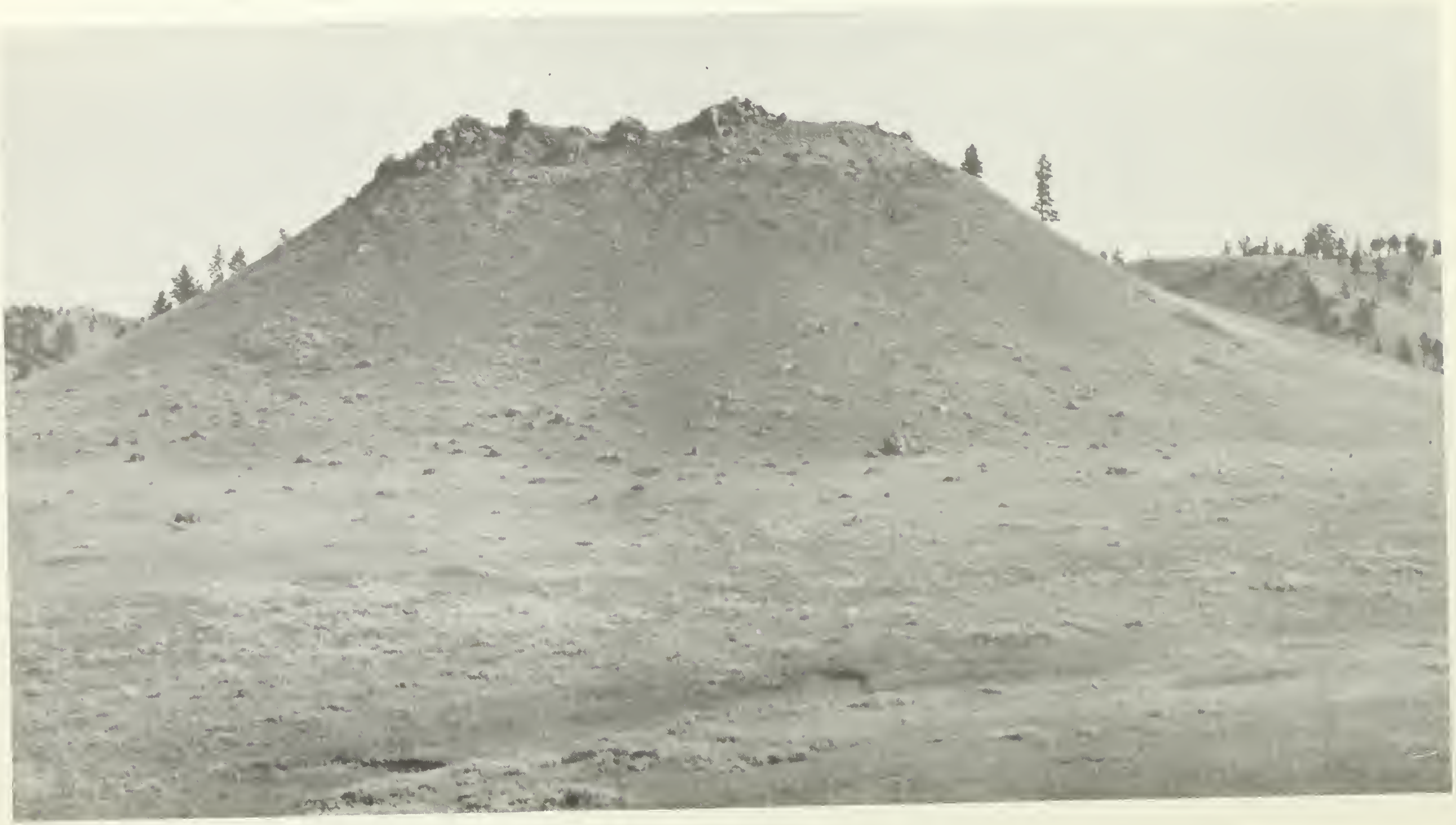


Figure 54 Top photo Baker, 1925. Bottom photo BLM, 1962. Time span 37 years.
The upper part of the Tongue River Basin, close to the Montana-Wyoming line.
The timber has increased both in occupied area and size. The grassland is dominated by western wheatgrass in both photographs. Sagebrush has not increased in extent or size, and density seems to have remained the same. Essentially there has been little change, the area is stable except for an increase in tree cover.



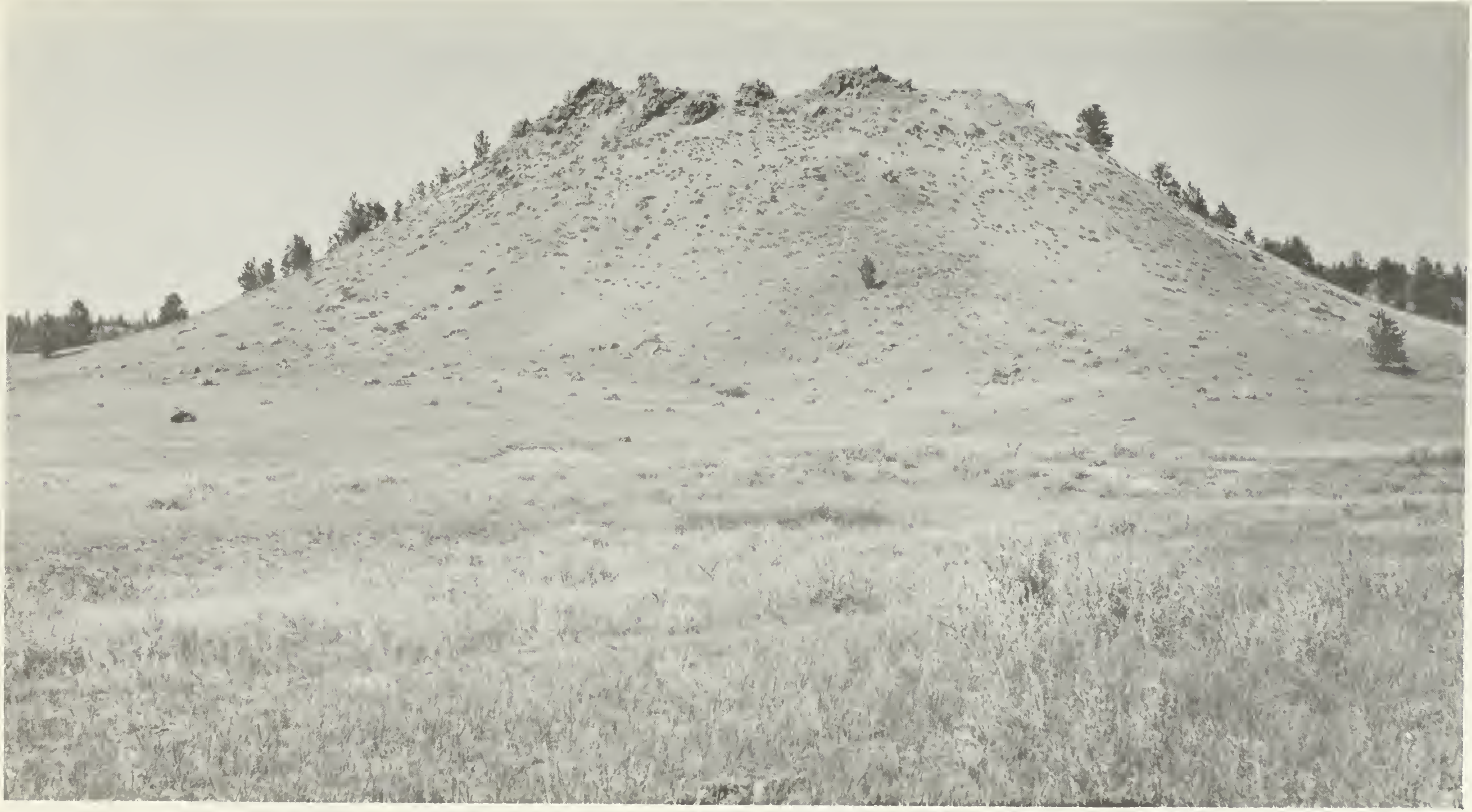
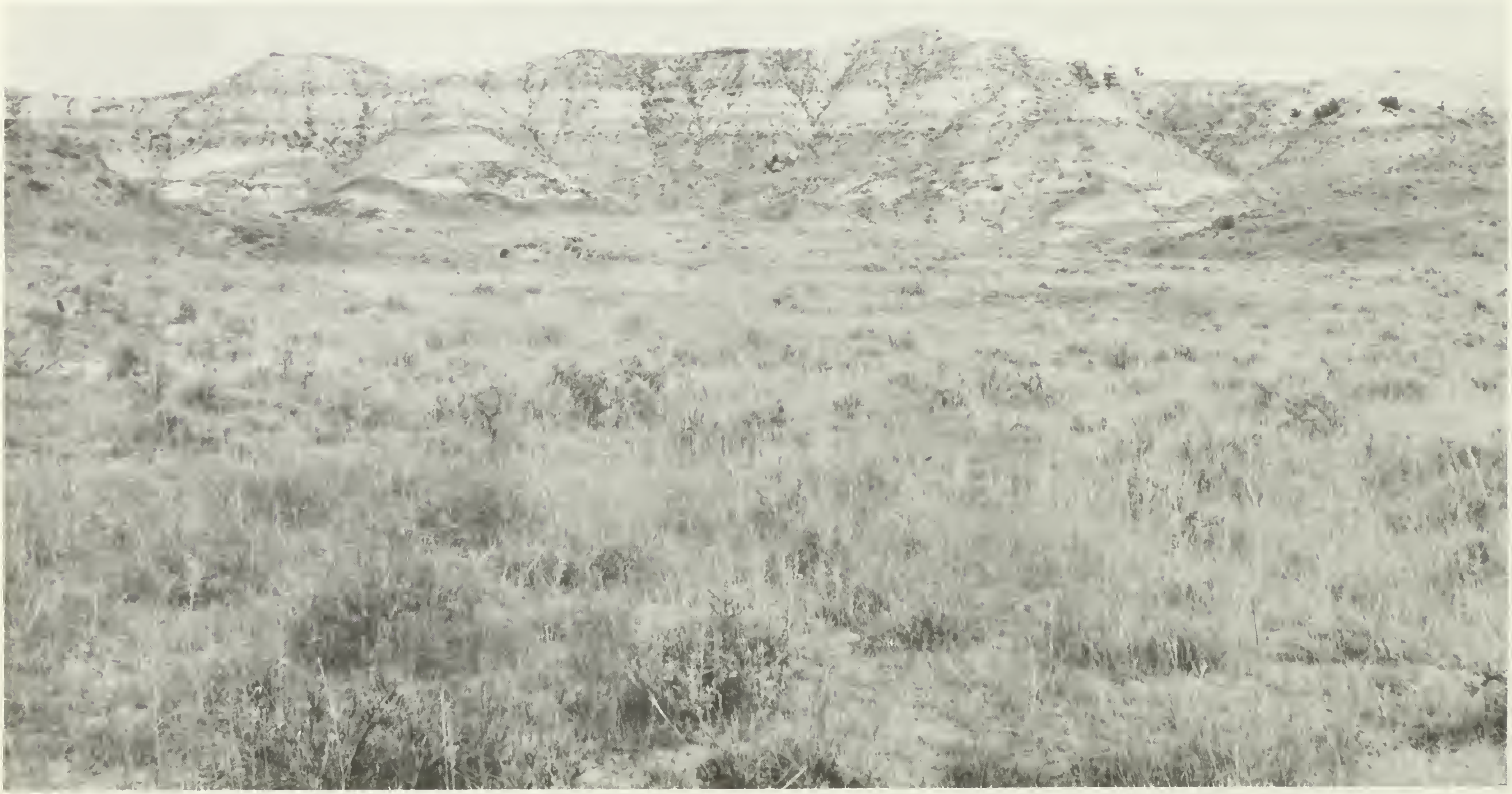


Figure 55 Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years. Southeast of Miles City, Montana.

Vegetation of the range is unchanged in species or in density, and erosion is much the same. A barren area in the center of the original photograph is the start of a stock dam which was never finished. Trees have increased amazingly in size and numbers.



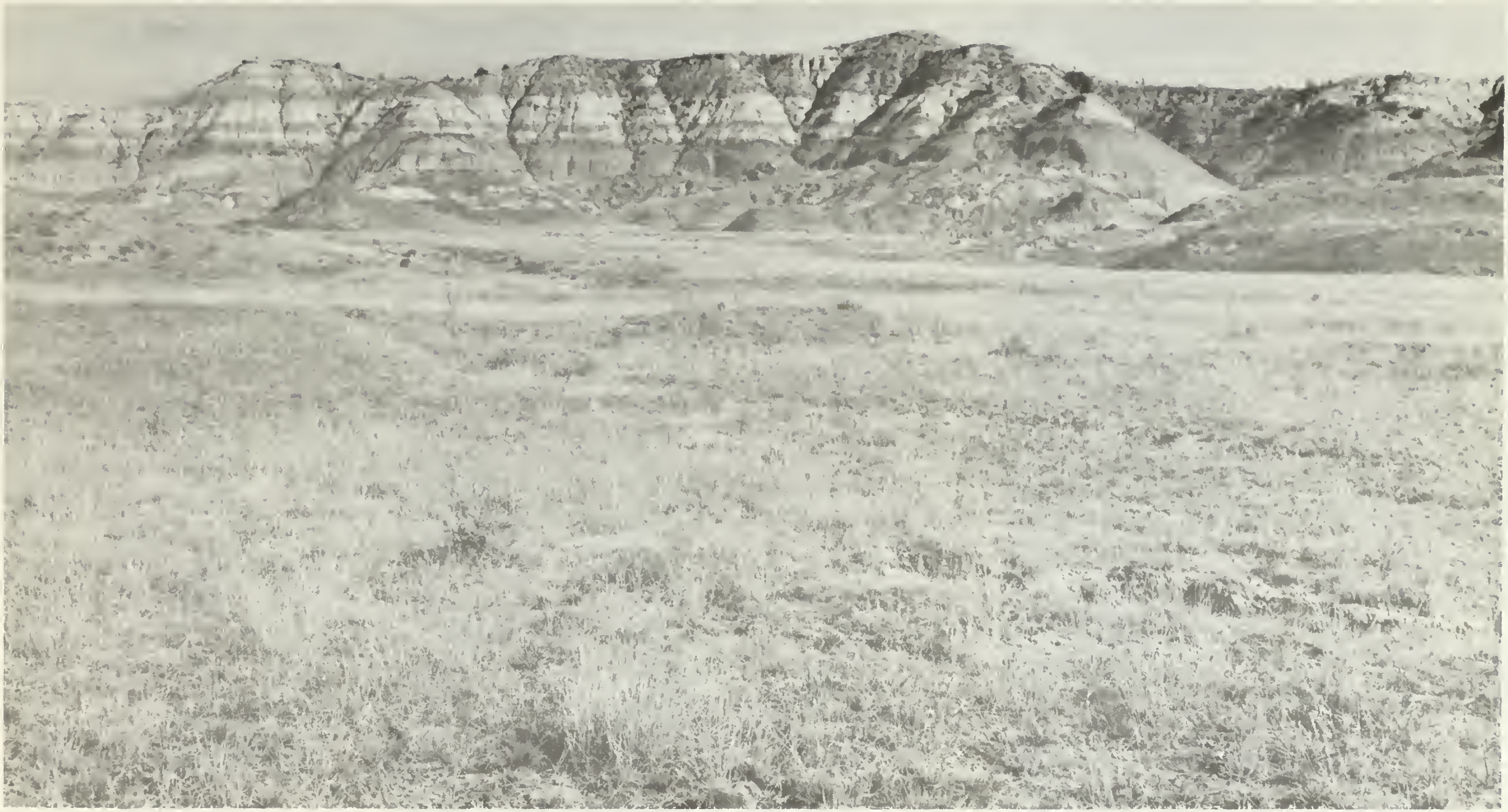


Figure 56 Top photo Collier, 1907. Bottom photo BLM, 1962. Time span 55 years. Southeast of Miles City, Montana.

Sagebrush is less evident. The ground cover seems of much the same density and grass species. Essentially there has been little change.

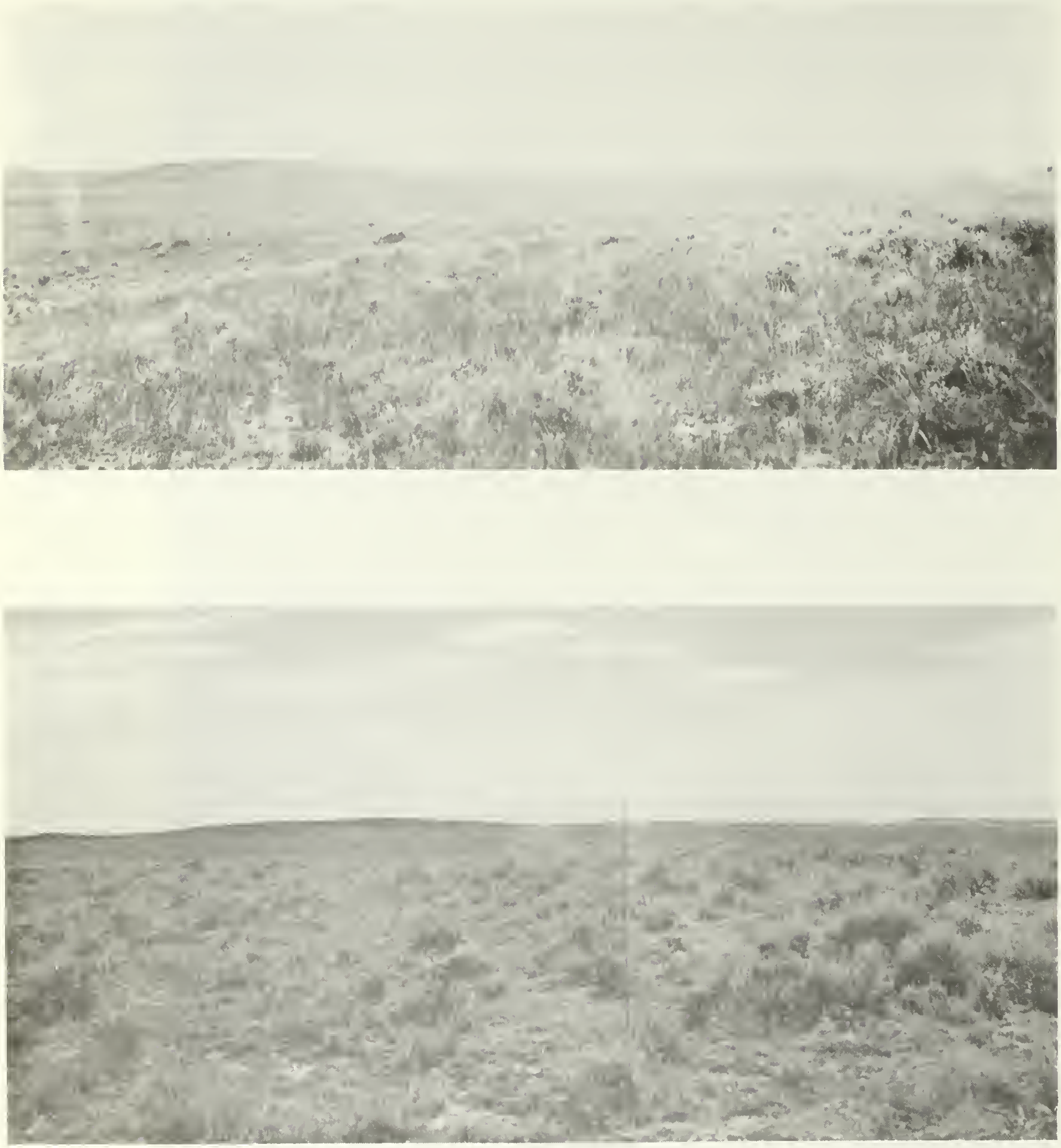


Figure 57 Top photo Baker, 1924. Bottom photo BLM, 1962.
Time span 38 years.
The upper Tongue River Basin, at the Montana-Wyoming line and within two miles of the divide.
An exact relocation was impossible. The approximate site of the original photograph was used instead, thus only a general trend may be predicated. Sagebrush plants in size and location are evidently stable. Range condition trend is downward with a replacement of mid-grasses by short grasses. The effect of management is probably the most important factor in determining the present condition and appearance of the range.

SOILS

Ninety percent of the basin soils were formed on sandstones and shales laid down as a part of the Great Plains in the Cretaceous or Tertiary periods.

Alpine Regions

Five percent of the Tongue River Area in the Big Horn mountains is too high and mountainous to develop deep soil. Excessively stony soils and barren rock outcrops are interspersed with soil pockets and benches. Above timberline, around 9,000 to 10,000 feet elevation, on Precambrian granites, soils form in a severe climate. These are Alpine Soils, shallow and high in organic matter, usually not over 12 inches deep but with pockets of moderate depth. Vegetation is turf-like, chiefly grasses or sedges, kobresia, alpine bluegrass, tufted hairgrass, sedges and tufted phlox.

Snowfall in the Big Horns is heavy. The soils saturated with the snowmelt of spring and early summer are continually subject to frost heaving and soil creep. Soil creep creates patterns of sag-and-swell microrelief; stone stripes are common.

Alpine Turf soils occupy sloping, well-drained sites. Their "A" horizon is strongly organic. These soils are acid and usually stony, gravelly, or both. Alpine Meadow soils occupy the transition between well-drained sites and the poorly drained sites which form Alpine Bogs. Both of these are usually less stony or gravelly than the Alpine Turfs. The soil depth of all varies from 6 to 15 inches.

The Alpine soils are grazed by livestock and wildlife; but their most valuable use is watershed storage and protection for the winter snowfall , the primary source of irrigation water.

Mountains

Fifteen percent of the basin's soils developed in the mountains under a cover of conifer forest, from timberline down to about 5,000 feet elevation. The cool, moist climate forms podzolic soils of low fertility. Podzols have heavily leached "A" horizons with a strong cementation below in the "B" horizons; similar but more fertile soils intermix on gentler slopes and sites with warmer temperatures.

Ponderosa pine, limber pine, Douglas-fir, Engelmann spruce, subalpine fir, and lodgepole pine grow on elevations which vary from 5,000 feet, at the base of the mountains, to over 11,000 feet. Average annual precipitation varies from 16 inches to 40 inches.

Average annual temperatures vary from 36° to 52° F. Much of the parent material is granite but sandstone, limestone and dolomite occur on lower elevations.

Raw organic matter commonly accumulates on the surface. Winter precipitation, most of it snow, occurs at a time of low biological and chemical activity. During spring thaw excess water moves into and through the soil. Soluble salts leach first, followed by a downward movement of clay. A profile develops with a thick, gray, leached "A" horizon overlying a thin to thick, usually brown "B" horizon with variable degrees of enrichment of soluble salts and clay.

Less precipitation, warmer temperatures, and less dense vegetation creates a dark-colored "A" horizon that is found in the Western Brown Forst and Gray-Brown Podzolic Soil Groups. Here the timber is often open and park-like, with scattered stands of mixed forest and grass.

The open parks and ponderosa pine stands with grass understory have a high grazing value. Additional values of the forested lands are water production, wildlife habitat, and recreation. In the Tongue River Area these are of greater value than any timber that is produced.

Mid-Elevation - Plains

The climate, from elevations above sea level of 2,500 to 5,000 feet is semi-arid, cool and temperate with mean annual temperatures from 40° to 52°F., and mean annual precipitation from 9 to 16 inches. The soils are frozen in the winter, slowing soil formation which resumes again in the warm summer months but is then often hindered by summer droughts.

Most of the parent materials are sandstone and shale, often discolored to shades of red by prehistoric fires that once burned in the subterranean coal beds. The burning coal produced slag flows and outcrops throughout the basin. The crushed reddish slag, or scoria, makes good road surfacing and building material. This reddish slag covers hundreds of square miles in the central part of the basin.

Fifteen to twenty percent of the subbasin is covered by fertile Brown or Chestnut soils. These soils are light-brown to dark-brown, with a gravelly profile and depths ranging from shallow to moderately deep. They have developed where the precipitation is relatively high but still so limited that it can support only native grasses. These are productive soils. The deeper soils of this group are usually under cultivation. Yields of spring wheat varies from 8 bushels to 20 bushels per acre.

Brown soils,with the greater area of the two groups, are limited to 10 to 15 percent of the basin. The shrub-grass plant cover is sparse; a part of the soil surface is typically bare. Moisture rarely penetrates to depths over 24 inches. Biological and chemical activity is limited to the upper part of the soil profile. Soluble materials are leached to limited depths. Carbonates generally accumulate at depths from 10 to 20 inches.

Brown soils have a thin, moderately dark, "A" horizon; a "B" horizon with prismatic and blocky structure; and a calcium carbonate accumulation in the lower part of the "B" as well as the upper "C" horizon. Local differences in parent materials, topography, microclimate, or vegetation create differences in horizons.

Chestnut soils are found only on relatively smooth terrain around 2,500 to 5,000 feet elevation. Precipitation is 13 to 16 inches and mean annual temperatures are 40° to 45° F. Chestnut soils are limited to four or five percent of the basin. Chestnut soils are well drained with dark granular "A" horizons and prismatic and block compound structure "B" horizons. The "C" horizons are a zone of calcium carbonate accumulation at about 12 to 24 inches.

The Chestnut soils and Brown soils are found only on the older land surfaces. Strongly differentiated profiles in either of these soils may have developed earlier during Pleistocene periods and under much different climatic conditions !

Brown and Chestnut soils are well suited for dryland production of small grains; wheat is the most important crop. Most of these soils, however, are under irrigation.

Mixed - Undeveloped Soils

The remaining soils of the basin, 60-65 percent, have undeveloped or immature profiles. Some are highly productive, such as the alluvial soils of the valleys which are usually deep and often under irrigation.

Some of the undeveloped soils are very shallow, rocky and produce meagrely, these are Lithosols and Regosols.

The more productive soils, the alluvial soils, develop from deep highly variable material. Alluvial soils are young with weak horizons. Development is limited to a small accumulation of organic material in the surface "A" horizon. In some areas soluble salts accumulate and saline vegetation is common.

Most of the alluvial soils lie next to the river which helps in irrigation. Poorly drained areas are used for pasture. Small areas of these soils are often in grass, brush and trees.

Other soils usually found in the drier sections in the plains have undeveloped profiles because of an excess of salts. Saline soils are commonly structureless but this will vary with the amount of salts originally present and the degree of leaching. Use is usually restricted to native forage plants; productivity varies from low, on the barren soils, to very high on the sub-irrigated meadows. (See Annex 5 on Soil Erosion.)

The principal shallow soils are Lithosols and Regosols, Rocklands and Badlands are less common.

Lithosols are shallow and immature with thin "A" horizons. Lithosols occur on fractured rock material and where the total thickness above bedrock is less than 20 inches, such as on the exposed, eroded, ridges and mesas. They have very stony profiles.

Profiles of the Regosols are largely influenced by the character of the parent materials. Soil development is limited to slight accumulations of organic matter to form thin "A" horizons with no underlying "B" horizons.

Regosol and Lithosol soils form where erosion has kept even with the weathering of the soft shale and sandstone. They occupy about 55 percent of the basin, upon the steeper slopes, with sparse vegetative cover, slow rate of soil development, and active geologic erosion. These soils are usually found on a dissected undulating to rolling plain of sandstone or shale bedrock. The soils, developed from rock changed by the heat of burning coal beds, are often reddish.

Regosol and Lithosol produce forage for livestock grazing and wildlife and are often attractive scenic areas.

Rocklands are exposed consolidated rock with no or a very shallow soil cover. Rocklands vary from 25 to 90 percent pure rock outcrop.

Badlands occur throughout the lower elevations from 2,300 to 5,000 feet but especially in the lower part of the basin. Steep to very steep, barren slopes dominate where weathered soil material is being removed by wind, water and geological erosion as rapidly as it forms. These Badlands areas are found principally on the shales and clays. Badlands are best suited for watershed and recreation. Camping, hiking, hunting and rock-hunting are common.

Most of the public domain lies on the non-agricultural, shallow, rocky soils and badlands. These soils have great value, however, and are managed for grazing, timber and watershed production, game habitat, hunting and picnicking and hiking, for much of the Bureau's land possesses a marked aesthetic appeal.

EROSION - PIPING

A form of erosion often overlooked but inherent to the entire Missouri River Basin is that of "piping". Piping is worldwide in occurrence especially in dry lands. It takes a destructive form with steep-sided gullies and lays waste large areas of soil. Burr, (1942), in a preliminary investigation on piping found as much as 20 percent of the area of livestock ranches, immediately adjacent to the Canadian River in Texas, were eroded solely by piping. The loss in productivity is drastic; many piped areas become barren, picturesque waste.

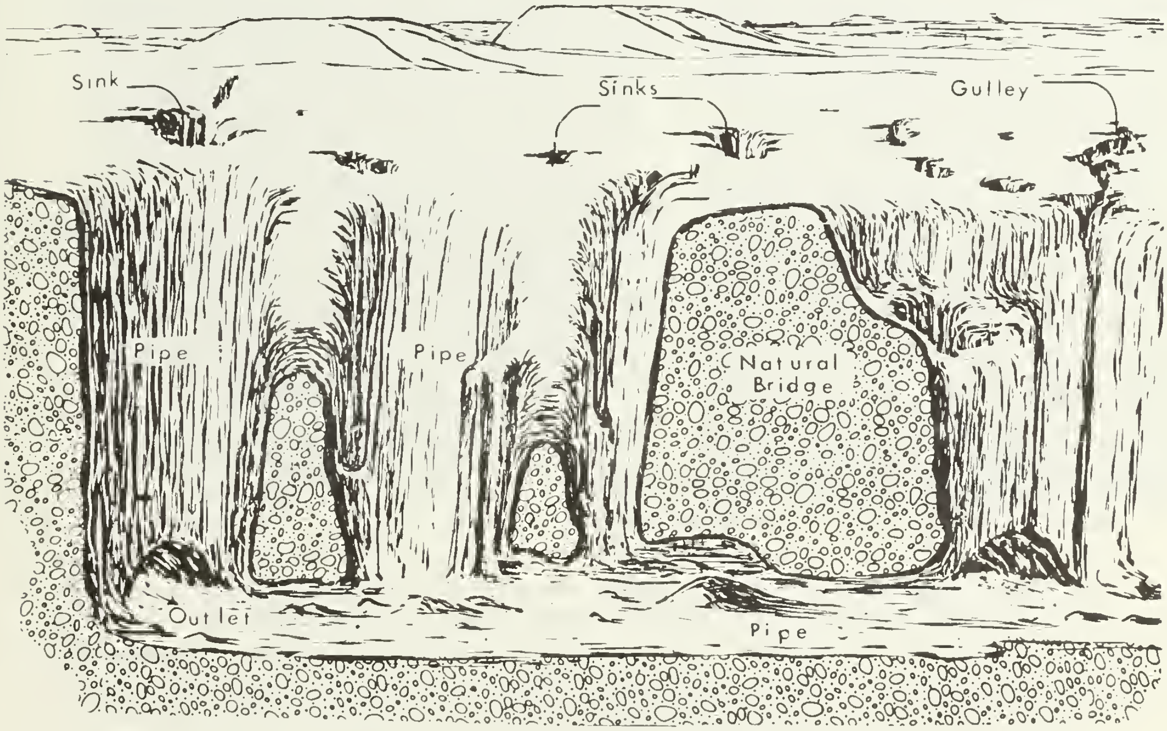


Figure 58 A diagram of piping, a form of erosion found in the Missouri River Basin. Vertical pipes or "sinks" outlet through horizontal pipes developed on an impermeable layer, into a gully, itself formerly a horizontal pipe. The gully developed by collapse of natural bridges. Topography of this nature is termed a "pseudokarst".

The worst problem is the difficulty of control. Figure 59. Other forms of erosion are normally controlled by vegetation or by surface structures designed to slow the transportation of soil particles. Water erosion is combated by terraces, water spreading and check dams; wind erosion is controlled by plant barriers and occasionally artificial barriers. With piping, which depends solely on water, a structure such as a terrace or dam will only aggravate the problem and have disastrous results.

Parker and Jenne 1/ state: "...Piping is the development of subsurface drainage systems in earth materials, to a depth no greater than the nearby base level of drainage. It results in a surface expression much like miniature solution depressions in limestone or dolomite terrains..." This resemblance is in appearance only. Solution plays no important part in development of piping. The erosion forms resulting are termed pseudokarst. (True karst topography is found in limestone or dolomite regions where, unlike piping, solution of rock in water is the creative force. Sinks, caverns, natural bridges, subterranean streams, sheer cliffs, and a general lack of surface water characterize karst terrain.)

As has been stated, all the Missouri River subbasins, without exception, have the prerequisites for piping, "...Sufficient water either to cause drainage through cracks or to saturate a layer of higher permeability than the layers below it, hydraulic head sufficient to move water through a subsurface rock, presence of a permeable (or deeply cracked) soil or bedrock above gully floor level, and an outlet for flow..." 2/ Figure 59.

The soils most susceptible to piping are found in all the Missouri River subbasins. These are alluvial often saline soils. The soils must contain about one-fifth montmorillonitic clay (a sandwich-like ionic structure in this clay can absorb as much as sixteen hundred times its weight in water). The soils must also dry thoroughly, at some time, or have a highly permeable stratum below the surface. Another prerequisite is presence of a sodium ion which causes dispersion of the soil structure (locally dry buried soils, such as loess deposits, may also pipe when wetted in some unusual circumstance). Silts and clays are the two main soils most susceptible to piping. Conditions favoring piping are so widespread that it is a serious problem in management of range lands and especially in the establishment of artificial structures such as dams or roads.

1/ Structural Failure of Western U. S. Highways Caused by Piping, U. S. Geological Survey, January 18, 1967, Parker,G. G.,and Jenne,E. A.

2/ Ibid.

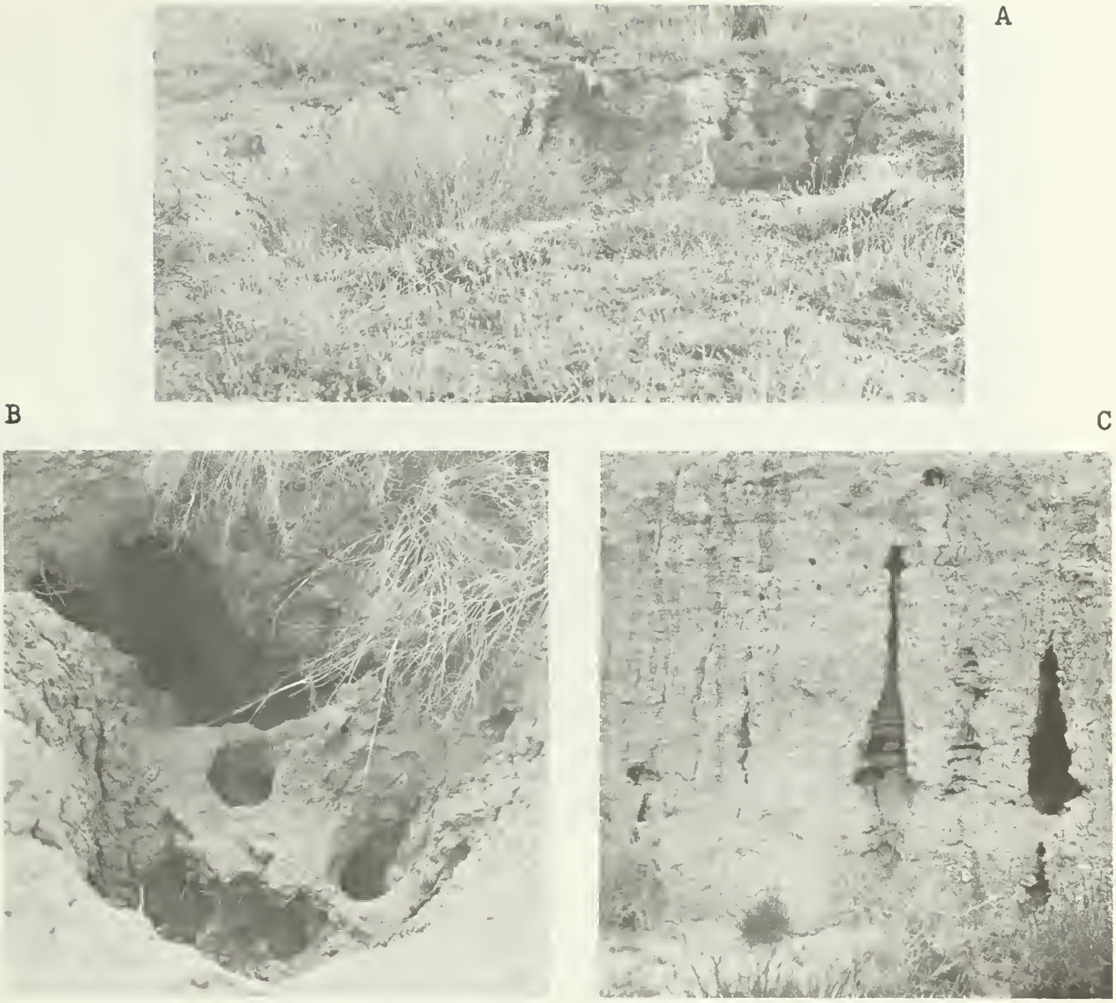


Figure 59
Piping often originates on fairly level ground. The large vertical pipe in "A" could have started when water runoff percolating downward encountered a long buried and dessicated lens of loess or silt, that upon saturation collapsed into a smaller space. The collapse would have been followed by a subsidence of the surface. Looking downward into a large pipe "B" shows a subsidence in which vertical pipes developed later.

Dry soils susceptible to piping usually develop wide deep cracks that extend downward several feet. Piping can start in these cracks even on steeply sloping soils. Surface runoff pouring down the crack enlarges it by cutting until a layer is reached where horizontal pipes must develop, then the water usually outlets into an arroyo or gully, such as that in "C", where the stream has now cut away its channel wall to reveal cross sections of vertical pipes.

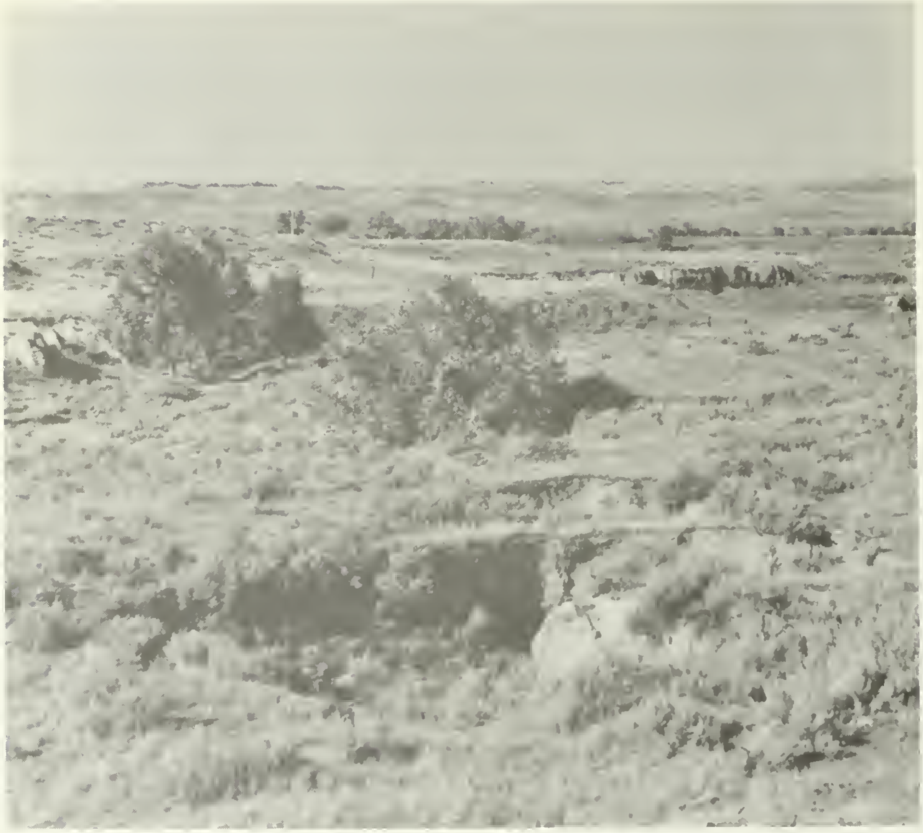


Figure 60 This gully is actually a collapsed horizontal pipe bridged over by a series of broad natural bridges of soil still in place. Eventually these collapse into a sheer walled gully.

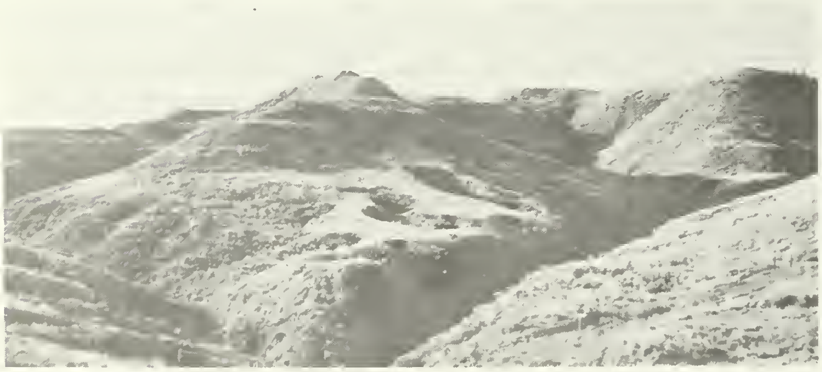


Figure 61 Sinks join together in gullies in mid-distance. These sinks were formed by collapse and subsidence of subsurface pipes which riddle the soil.

The most common type of piping encountered in the Tongue basin is one where cracks are formed by a soil drying and shrinking. Runoff enters this crack at the soil surface and moves down eroding the walls. If the hydrologic gradient is steep a fine-grained sediment may be transported in suspension along this certical crack, then through a horizontal crack into an outlet on the side slope of an arroyo or gully. Cracks are the usual starting point for a pipe; sediment deposits, however, such as loess below the surface, may be moistened to saturation and slump to start infiltration into a small sink. The start is like that in Figure 59.

Construction such as a dam or wall confines water behind a barrier, creating hydraulic heads that can start a subsurface flow carrying water-saturated earth materials. This discharges on the down side of the barrier. The Bureau of Land Management and other land management groups encounter this entrainment type of piping in construction of stock or erosion control dams on soils or base material susceptible to piping. Once piping starts the overlying structure will often collapse.

A third type of piping is similar to the entrainment type. In this a hydraulic head transports clay and silt and sand through a stratum with sufficient velocity to maintain its identity and discharge them into a gully. These gullies are formed and enlarged through collapse and coalescence of the piped structures, figures 60 and 61.

Piping can form extensive networks of caves. In badlands on the headwaters of the North Platte River, pipes in a clay derived from saline shales extend for miles in tubes from 8 to 12 feet in diameter. These ramify throughout the entire area, and spectacular scenery is often formed by collapse of the tubes.

ECONOMIC AND SOCIAL DEVELOPMENT

Tongue River farmers and ranchers find that greater investments in land, livestock and machinery, with the attendant increasing cost of operation, requires larger farms, both in terms of land and livestock. The size of the operation necessary to break-even is increasing. Total investment in the farm unit is expanding faster than the value of land and buildings alone. The total gross sales of agricultural products, however, has not increased proportionately in the past two decades. The income per farm has increased only to be offset by the increase in operating costs, such as taxes, interest, and machinery thereby leaving a close cost-price ratio. This cost-price squeeze is forcing the farmer and rancher to increase the size of his unit while accepting a smaller margin of profit per unit.

The state and national trend in agriculture has been a declining number of farms with increasing size and value. This trend is followed in the Tongue River Basin. From 1954 to 1959 farm numbers dropped at a rate of about 115 per year. They totaled 2358 in 1959. At the same time they increased accordingly by about 900 acres so that the average farm included 5100 acres in 1959.

The parallelism of the basin with the history of the states is shown in that the State of Montana had approximately 50,564 farms in 1935. This number has steadily declined to the present figure of 27,020 in 1964. The State of Wyoming reached a peak of 17,487 farms in 1935, which declined to the present figure of 9,038 in 1964. (A part of the decrease in farm numbers is due to a change in census definition.)

This steady decrease in the number of farm units plus the replacement of manual labor by machinery reduces numbers in the farm labor force. The rural population is also dropping because of the tendency of farm families to move into the smaller towns, even though they sometimes continue to operate the same farms.

Population trend by whole counties of the agriculture-based economy of the Tongue River Basin follows.

County	1930	1940	1950	1960
Big Horn, Montana	8,500	10,400	9,800	10,000
Custer, Montana	11,200	10,400	12,200	13,200
Powder River, Montana	3,900	3,200	2,700	2,500
Rosebud, Montana	7,300	6,500	6,600	6,200
Sheridan, Wyoming	16,900	19,200	20,200	19,000

Most of the agricultural income comes from irrigation farming; the water for which comes from the Tongue River and its tributaries. Tongue River gets most of its water from the snowpack in the Big Horn Mountains in Wyoming. Maximum stream flow out of the Big Horns usually comes in May and June with good flows commencing late in April, mounting in May, reaching maximum in June, reducing in July, and growing low in August and September. Most is used for irrigation in Wyoming and close to the base of the Big Horns. Maximum stream flow early in the irrigation season permits bypassing the ditch heads in Wyoming, but beginning in July the entire flow of the Big Horn streams is usually diverted for Wyoming irrigation.

Wyoming's part of the basin has about 88,000 acres irrigable under existing facilities. About 68,000 acres are irrigated three times annually and 20,000 are irregularly flood-irrigated. Only the oldest water rights have ample water during low flow years; then a definite shortage develops in late summer. Supplemental water is needed on 38,000 acres of irrigated land.

Irrigation development proposals for Wyoming by the Bureau of Reclamation include storage, diversions from heavy flow tributaries into areas with good land but deficient stream flow, and improvement of distribution systems for greater efficiency and reduction of water loss.

Most of Montana's irrigation depends on the Tongue River Reservoir and diversions from source tributaries. Maximum average storage of the reservoir comes in June with 42,000 acre feet. Depletion of storage begins in July and continues at about 6,000 acre feet per month until the end of November. During December average depletion is about 1,000 acre feet. In January the reservoir reaches the average low storage of around 10,000 acre feet.

Average monthly releases from the reservoir increase from a minimum of around 10,000 acre feet in February to a maximum of about 80,000 acre feet in June, when natural flow and irrigation demand are both usually high.

Maximum flow figures reflect heavy natural flow coincident with high storage in the dam. These releases vary from 15,000 acre feet in January of 1948, to 227,000 acre feet in June of 1944. Average annual water release is 304,000 acre feet. The annual minimum water flow recorded was 111,000 acre feet in 1961; the annual maximum was 550,000 acre feet in 1944.

The Montana water supply is ample, with delivery virtually assured throughout the season to all lands below the Tongue River Reservoir. The reservoir effectively regulates the stream flow and stores sufficient water to irrigate a large additional area of land in the Tongue River valley, but irrigation is dropping in popularity. A considerable acreage of Montana lands once in irrigation has been abandoned,(see discussion in main text), because of increasingly strict water sales with higher cost of water, lower prices for alfalfa seed, and the advantage of buying rather than raising alfalfa hay.

Much of the stored Tongue River water is diverted to the Yellowstone River valley via the Yellowstone Irrigation District canal.

Mineral - Industrial Development

The State of Montana estimated a need for 100,000 acre feet of water for the Tongue River industrial development. The water releases from the reservoir since 1938 show the minimum to have exceeded that amount.

Six companies (including some of industries largest firms) are interested in petrochemical development, probably dependent on the process developed at Cresap, Virginia. This process uses a cobalt-molybdenum catalyst to combine coal's carbon with hydrogen. The resulting hydrocarbons can be converted to a petroleum-like substance at the coal field; it is then piped to refineries. Gasoline can be produced for 10½ to 12 cents per gallon "refinery rack" (a wholesale, undelivered) price. This would make it competitive with about 50 percent of the gasoline now produced in the U. S.

The Cresap process and the refining of its product both require large amounts of water for cooling and condensing, although only about one half as much water for the same amount of energy as a coal-burning power plant .

Thermal power plants and refineries use water for cooling. Petrochemical plants use water for that and for a part of the processing in which the water is consumed.

Refining processes raise the temperature of water creating problems on fishing streams. But the lower reaches of the Tongue are not important for sport fishing. Thus only problems attendant on waste disposal have to be met.

Manufacturing

Complete data reflecting the economic importance of manufacturing to the basin area is not available. In 1961 Sheridan County reported 337 employees receiving a payroll of $1,488,000; no information is available on gross income from manufacturing. In 1958 Custer County reported nine establishments hiring 75 employees and adding $1,070,000 to the economy from manufacturing. Rosebud County reported six establishments hiring 84 employees and adding $187,000 to the county economy. Big Horn and Powder River Counties reported six and two establishments respectively. Although manufacturing is economically important to some of the basin counties it is almost insignificant to the basin.

Transportation

In 1859 Captain Raynolds evaluated the potential for transportation in the basin. Of the upper end he wrote:

> "...At the eastern base of the Big Horn mountains there is a belt of country some 20 miles in width that is peculiarly suitable for a wagon road, and which I doubt not will become the great line of travel into the valley of the Three Forks. Being immediately at the base of the mountains, this strip is watered by the numerous streams which rise in the hills but soon disappear in the country below, while the upheaval of the mountain crest is so uniform in direction that a comparatively straight road can be laid out close to their foot without encountering grades that are seriously objectionable. I travelled through this region with heavily loaded wagons in the fall of 1859 without embarrassment..."

On the lower end of the basin Raynolds was not overly impressed with possible water routes on the Yellowstone River:

> "...Considering the difficulties encountered from the current of the Missouri I cannot but think that the navigation of a stream whose waters possess such a greatly accumulated velocity is at least problematical..."

But of the Yellowstone's valley for east-west travel by rail he wrote enthusiastically:

> "...The broad valley of the Yellowstone affords peculiar facilities for a railroad, it is, moreover, the most direct route to the important region about the Three Forks with all its agricultural and mineral wealth.
>
> " The only serious obstacle that would be encountered in this entire distance is the ridge between the waters of the Gallatin and those of the Yellowstone and as this is shown to be only about 1,700 feet in height, it is believed it could be crossed without great difficulty, especially as the approaches upon our side are shown by profiles of our route to be of easy grades.

> " The valley of the Yellowstone can be reached with comparative facility near the mouth, or near the junction of the Powder, but between these points the country lying to the east is represented, by all who have passed over it, as often barren and impracticable.."

In accordance with his predictions railroad facilities are available in the northern and southern ends of the basin. The Chicago, Burlington and Quincy Railroad serves Sheridan, Wyoming with the Northern Pacific serving Miles City, Montana. Both railroads maintain passenger and freight services in both locations.

LAND CLASSIFICATION RECONNAISSANCE (Circa 1924)

U. S. Geological Survey in 1924 classified lands for the Great Plains into three use classes - lands productive under irrigation, by dry-farming, or by grazing.1/ Dry-farming lands in turn were sub-divided into three sub-classes; farming, farming-grazing, and grazing-forage lands. Grazing lands were sub-divided into two sub-classes; tillable and non-tillable lands. Standards of soil, topography and productivity are given in Appendix E. National Parks and Forests were excluded. Map, figure 19, in the main text, summarizes the report.

Range Vegetation in Land Classification (1924)

The Geological Survey divided vegetation into characteristic associations of forage or non-forage plants. In computing carrying capacity the Geological Survey estimated a grazing season of from five to seven months. Their figures, in animal units per section, are generalizations and have been converted to the more common "acres per animal unit month" (A/AUM), to aid comparison with recent findings.

Plant Associations - Definitions U. S. G. S. (1924)

Plant associations and their attributes as described by the Geological Survey were: 2/

Grama grass association, a predominantly short-grass type found on the farming-grazing land, with a carrying capacity of 3½ to 6½ A/AUM.

Grama and needlegrass association, a more productive type, with a carrying capacity of 1½ to 3½ A/AUM.

Grama and threadleaf sedge association, an important indicator of deficient soil moisture on shallow, rocky or gravelly soils; carrying capacity of 3½ to 6½ A/AUM, and usually classed as farming-grazing land.

1/ Land Classification of the Northern Great Plains, Montana, North Dakota, South Dakota and Wyoming, U. S. Geological Survey 1929. Unnumbered.

2/ Currently accepted standardized plant names are substituted for U. S. G. S.,plant names for uniformity. The original names used in 1924 are given in Appendix C.

Grama and western wheatgrass association, characteristic of the heavy clay loams, usually indicating farming-grazing or grazing-forage land; carrying capacity of 2½ to 4 A/AUM.

Grama and fringed sagebrush association, characterized soils with moisture in excess of the amount required for grama grass alone; classed as farming-grazing land with carrying capacity of 3½ to 7 A/AUM.

Grama and broom snakeweed association, generally found on the tillable grazing land, with carrying capacity of 6½ to 12 A/AUM.

Grama and silver sagebrush association. Found on deep, well drained soils capable of cultivation; carrying capacity of 2½ to 4 A/AUM.

Grama and buffalo grass association, similar to grama grass alone, but indicative of crop failure during years of less than average rainfall; carrying capacity of 4 to 6½ A/AUM.

Grama, buffalo grass and western wheatgrass association, usually found on the farming-grazing or grazing-forage land; carrying capacity of 4 to 6½ A/AUM.

Western wheatgrass association; carrying capacity of 5½ to 6½ A/AUM.

Sagebrush association, classed as grazing-forage and grazing lands, with carrying capacity of 6 to 9 A/AUM.

Forest associations, provided occasional grazing, but regarded as of low carrying capacity.

Salt grass association, regarded as indicative of soils containing sufficient alkali to preclude production of dry land crops.

Land Classification by County (1924)

The following excerpts from the 1924 Geological Survey Land Classification report are given here because of their value for comparison with present day conditions.1/

1/ The U. S. Geological Survey report of 1924 used exceptionally long paragraphs; for ease in reading, the original text is broken into shorter paragraphs.

Big Horn County (1924)

"The soil ranges from clay loam to sandy loam over most of the area mapped as tillable. In the Big Horn River Valley the soil generally is somewhat heavy, ranging from clay to clay loam, and most of the river valleys have a similar soil. Some of the heavy-soil bottom lands are strongly alkaline. The eastern part of the county has numerous red scoriacious or clinker-like hills formed by the burning of coal beds, and soils at many places in this area are mixed with particles of this clinker formation.

"The vegetation of the clay-loam and sandy loam bench lands is of a grama and needlegrass type, which is mixed with bluestem wheatgrass on the heavier soil and with threadleaf sedge on the lighter. Big sagebrush and wheat grass are the dominant species on the heavy clay soils, and the alkaline soils support a growth of salt grass and greasewood. Silver sagebrush is conspicuous on deep loam soils that have a favorable amount of moisture. Broom snakeweed is scattered over shallow soils or over-grazed areas, and fringed sagebrush grows on abandoned plowed lands. Little bluestem is conspicuous in the scoria areas of the eastern part of the county and elsewhere on steep sandy or rocky slopes. Prairie sandreed is found in some places with little blue stem and also occurs in bunches scattered over the light sandy soils of the county.

"A considerable portion of the county, especially the higher areas, is timbered, carrying for the most part a more or less scattered growth of small ponderosa pine, with numerous open grassland parks. Black chokecherry, saskatoon serviceberry, buffalo berry, rose bush, snowberry, currant, and other shrubs occur along the smaller creeks, and cottonwood trees grow along the larger rivers.

"The total area of the county is 3,209,000 acres, of which 3 percent is classified as irrigated land, 3 percent as farming land, 8 percent as farming-grazing land, 6 percent as grazing-forage land, and 80 percent as grazing land.

"As about 80 percent of the entire county is classified as valuable only for grazing the livestock industry is the outstanding one. The range is used primarily for spring, summer and fall grazing, although at lower altitudes where the range is protected in summer some winter grazing is done. The average length of the grazing season is eight months, the livestock being fed on hay for at least part of the time from about December 15 to April 15.

"The grazing capacity of the land ranges from about 20 animal units to the square mile on the poorest-grassed land to approximately 60 on the best-grassed lands, averaging approximately 35 or more. The number of range stock in the county on January 1, 1925, was equivalent to about 64,900 animal units, or less than 14 animal units to the square mile." 1/

Custer County (1924)

"The soil of the old plateau surface is chiefly sandy loam or clay loam. Some of the terraces have a shallow sandy-loam soil underlain by gravel, and others have a sandy or gravelly soil. The valleys have a clay loam or clay soil that is alkaline in places.

"The vegetation of the uplands is dominated by grama grass, which is associated with bluestem wheatgrass on the heavier soils and with needlegrass, prairie june grass, and threadleaf sedge on the medium and light textured soils. The clay-loam bottom soils support a grama and bluestem wheatgrass type, which is associated with silver sagebrush where the soil is of good depth and with big sagebrush or black greasewood where alkali is present.

"Small areas of pine hills occur that have a scattered growth of ponderosa pine with an undergrowth including the more prominent plains grass and weed species and small patches of little blue stem forming a conspicuous growth on the steeper slopes. The timber in these hills has little merchantable value and is used principally for posts or firewood.

1/ An eight month grazing season, as estimated in the 1925 report, would result in a rate of stocking equivalent to 4 surface acres/animal unit month (SA/AUM) on the lowest quality range; on the best range the equivalent would be 1.3 SA/AUM,and the average on all land would be 2.3 SA/AUM. The actual rate of stocking in 1925 was 5.7 SA/AUM. One cow with calf represents the standard "animal unit"; in the case of sheep, 5 adult animals are the equivalent of one animal unit.

"A few ash and boxelder trees grow along some of the intermittent creeks, and such shrubs as black chokecherry, saskatoon serviceberry, buffalo berry, willows and silver buffaloberry are prominent in coulees and low pockets that receive some extra moisture through surface runoff. Groves of cottonwoods occur along the larger streams.

"The county contains an area of 2,416,000 acres, of which 1 percent has been classified as irrigated, 8 percent as farming-grazing land, 14 percent as grazing-forage land, and 77 percent as grazing land."

Powder River County (1924)

"Erosion has exposed extensive coal deposits, many of which have been burned along the outcrop leaving a brilliant-hued scoria that is a conspicuous feature of the landscape.

"The alluvial valleys have a soil ranging from coarse sandy loam to a heavy clay or gumbo. In the valleys of the Powder River and its tributary, the Little Powder River, the soil along the river channel is very sandy, but that at the outer edge of the flood plain is a heavy clay. In the smaller stream valleys the soil, in general, is clay or clay loam. The upland soil is a sandy loam for the most part.

"The vegetation of the sandy-loam uplands consists of a grama and needlegrass type associated with prairie june grass, some bluestem wheatgrass, and fringed sagebrush. Bluestem wheatgrass and big sagebrush are the dominant heavy-soil species. In the larger valleys groves of cottonwood border the stream channels, and silver sagebrush is a conspicuous plant growing in association with grama grass and bluestem wheatgrass. In the draws and coulees among the hills where the soil receives some extra moisture through surface runoff, the plains grasses form a good sod and are supplemented by such shrubs as saskatoon serviceberry, silver buffaloberry, American plum, black chokecherry, rose, buffalo berry, and silver sagebrush.

"The sharp-crested ridges support fringes of ponderosa pine and an excellent growth of such species as grama grass, bluestem wheatgrass, bearded bluebunch wheatgrass, little blue stem and a number of weeds. There is practically no merchantable timber outside the national forest, and the principal use of the trees is for posts or building logs.

"The county includes an area of 2,102,000 acres of which 19 percent is included in the Custer National Forest, 13 percent has been classified as farming-grazing lands, 9 percent as grazing-forage lands, and 59 percent as grazing lands."

Rosebud County (1924)

"In the southern part of the county, the upland plains have a sandy-loam or clay-loam soil that is both fertile and easily cultivated. In the rough areas heavy clays predominate, although coarser-textured types are found on small tracts.

"The loam soils of the uplands in the southern part of the county support a good growth of grama grass, needle grass, bluestem wheatgrass, prairie june grass, and a scattering of silver sagebrush. Threadleaf sedge is prominent on the light soils. On the larger alluvial flood plains groves of cottonwoods line the stream channels. In the small coulees snowberry, rose, black chokecherry, saskatoon serviceberry, silver sagebrush, and buffalo berry form a prominent part of the vegetative cover, which includes most of the common plains-grass species.

"The pine-hills type is common in the southern part of the county and is featured by a scattered growth of scrubby ponderosa pine which is of little value except for fence posts or firewood. Little blue stem is prominent on steep slopes in areas of this type.

"The county includes an area of 3,196,000 acres of which 3 percent is included in the Custer National Forest, 1 percent is irrigated, 7 percent has been classified as farming-grazing land, 6 percent as grazing-forage land, and 83 percent as grazing land.

"The grazing land of northern Rosebud County has an average carrying capacity during the normal season of 18 to 25 animal units to the square mile, but in the southern part the carrying capacity is much higher and averages approximately 30 units. As 83 percent of the county is mainly valuable for grazing, the livestock industry will always be an important one here. The number of grazing animals in the county in 1924 was less than 13 animal units to the square mile of non-crop land which is probably 40 percent below the normal feeding capacity of the entire county."

Sheridan County, Wyoming (1924)

"The surface features consist of rough and precipitous mountain slopes and extensively eroded high plains which in the breaks along the Powder River have the appearance of badlands. The soils of the plains are mainly clay loam and sandy clay loam modified in places by areas of sandy loam gumbo. In the Big Horn Mountains where soil has developed it ranges from clay to sand and gravel.

"The vegetation of the plains consists mostly of grama grass and bluestem wheatgrass, with more or less buffalo grass, threadleaf sedge, and needle grass as secondary species on light-textured soils and big sagebrush on heavy soils.

"Juniper and ponderosa pine occur on some of the ridges. In the Big Horn Mountains a sagebrush and weed type of vegetation is found on the lower slopes and plateau areas and a forest type on the upper slopes.

"The total area in the county is 1,640,000 acres, of which 7 percent is irrigated, 10 percent farming-grazing land, 15 percent grazing-forage land, 44 percent grazing land, and 24 percent in the Big Horn National Forest. The irrigated lands lie in the valleys of the Tongue River and its tributaries, and in the valleys of Clear Creek and the Powder River.

"The grazing land in the plains has a carrying capacity ranging from 20 to 50 animals units to the square mile, with an average of 30 animal units; in the mountains the average is about 40 animal units. Winter grazing is practicable only in the plains, and even there supplemental feeding is necessary during severe storm periods.

"The mountain ranges are used as summer range from June to October for cattle and mainly during July, August, and early September for sheep. The county is well settled and utilized. The total number of range livestock in the county is equivalent to 76,000 animal units which is nearly 32 animal units to the square mile of land used for grazing in 1924."

ANNUAL PLANTS

Annual or biennial plants often occupy the range land suddenly and in such abundance that the perennial vegetation is blanketed. For example, yellow sweetclover, Melilotus indica, covered thousands of acres in central Montana in 1963. The ground was completely obscured, most of the blossoms were waist-high. The following year only traces of the tremendous crop were apparent.

In 1961 on the lowest part of the Tongue River Area, around the juncture of Pumpkin Creek with Tongue River, annual grasses -- Japanese brome, Bromus japonicus, downy chess, Bromus tectorum, and sixweeks fescue, Festuca octoflora, covered the range on approximately 27,000 acres of public domain. Figure 62. The proportion of annual grass production to that of perennial grasses ran 90 percent annual grasses, 10 percent all other species combined. Figures 63 and 64. Private lands were covered in the same way.

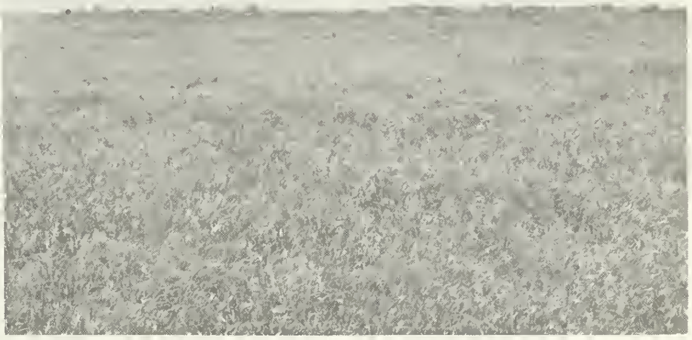


Figure 62 Annual grasses covered the range in the lower Tongue River Area in the spring of 1961. Several years of drouth followed by cold, wet spring produced this cover of 90 percent annual grasses.

Annual grasses were no problem locally on the shallow, rocky soils. Deeper, moderately saline soils were the most heavily invaded. This annual cover extended west into the Middle Yellowstone Basin, on the south side of the Yellowstone River. Immediately north of the river annual grasses were in normal amounts on the often heavier clays and silts.

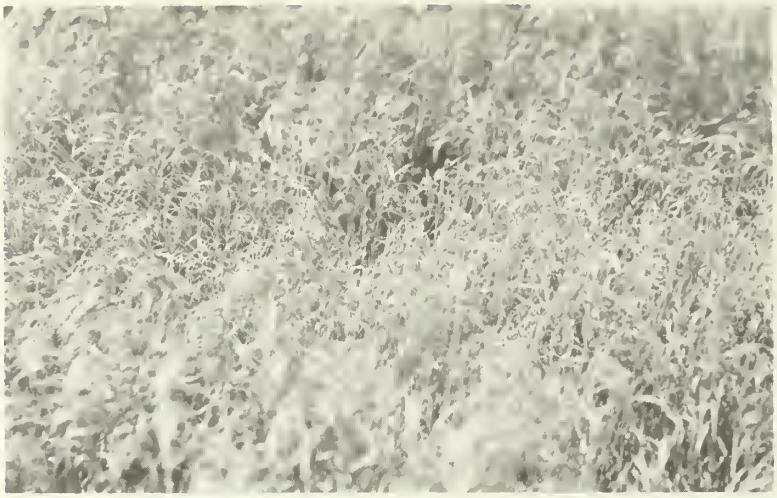


Figure 63 Closeup of ground cover of annual grasses shown in Figure 62.

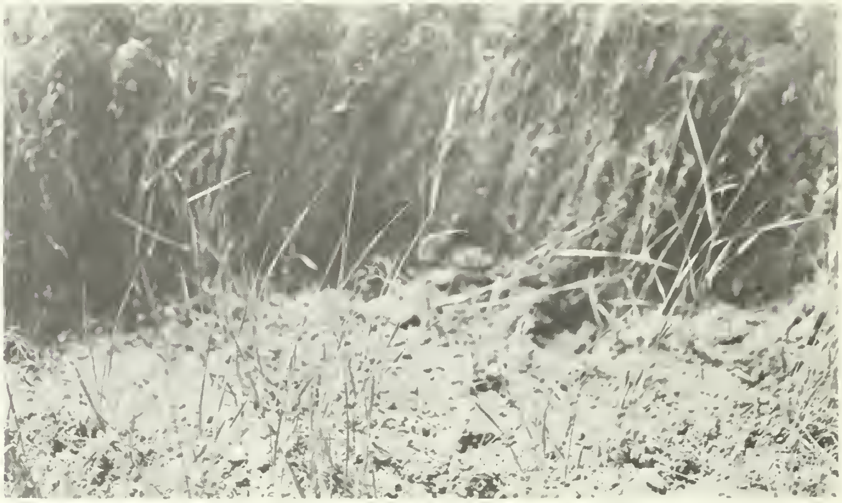
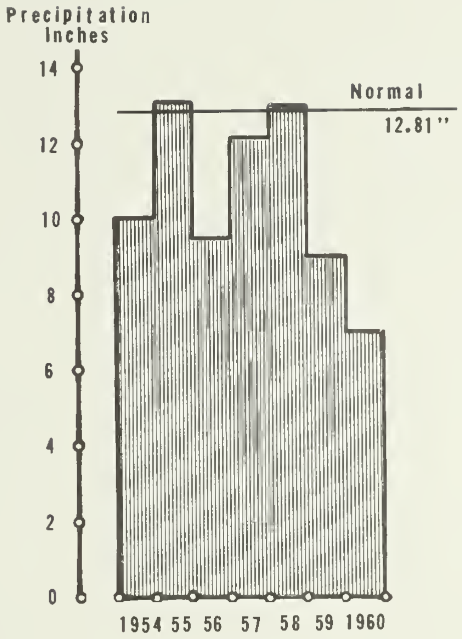


Figure 64 The camera was unchanged from the position in Figure 63. Annual grasses taken out to show the scattered perennial grasses, completely dominated by the annuals.

The problem of annual grass cover was so great the "annual" are was reinventoried the following year. At this latter date annuals, in the same area, seldom reached 10 percent of the vegetation.

Annual cover is dependent on the effects of weather, soil and past history of use. Figure 65 shows an extended period of below average precipitation prior to examination yearlong. Perennial plants were weakened.



The rainfall in the lower Tongue River Basin was below normal from 1954 to 1960. Of 7 years, 5 were below normal; by 1960 the precipitation had dropped to almost one-half.

Figure 65 Annual Precipitation. Miles City, Montana 1954-1960

The spring of 1961 had numerous rains and low temperatures which encouraged the annuals. The shallow, rockier soils had better soil/water relationships and the perennial grasses competed successfully with the annuals. The deep loams and sandy loams normally have good water relationship except most of the soil is often somewhat saline. Livestock use on level lands is usually heavier than on surrounding hills but the ranges were not necessarily over-heavily used because the large area of annuals included several ranches and types of management. The annual cover in this area is evanescent; it had dropped back to normal the next year. Annuals are normally a part of all range sites inasmuch as several nearby relict areas, ungrazed and inaccessible to livestock, were found to have from 10 to 15 percent of their plant cover made up of annual plants.

Comparisons of effects of soils and use under the same climatic conditions were easily done on surrounding areas.

Conclusion

The annual plant invasion of the deeper saline soils on the lower Tongue was due primarily to climatic effects on vegetation. Soils and past use had definite but lesser effects.

APPENDIX C

Section 1 Range Vegetative Types

Section 2 Method of Rangeland Inventory

Section 3 Guide to Plant Names as Used in U. S. Geological Survey 1924 Land Classification

Section 4 Definitions of Land Classes Used by U. S. Geological Survey Land Classification (1924).

APPENDIX C Section 1

RANGE VEGETATIVE TYPES

Authority BLM Manual 4412.11A

"Vegetative Types. The aspect vegetative types which are first used in mapping an area into range types are the same as the 18 standard types established some years ago.

"1 - Grass. Includes grassland other than meadow and secondary meadow. Perennial grasses predominate and determine the aspect, although forbs and shrubs may be present. Examples of types are: grama-buffalo grass, bunch grass, wheatgrass-sedge, alpine grassland, and blue stem.

"Where it is desirable to distinguish short and tall grass from mid-grass, these ecological variations may be designated, 1S-shortgrass and 1T-tall grass.

"2 - Meadow. Includes areas where sedges, rushes and moisture-enduring grasses predominate. Two classes of meadows are recognized: wet meadows and dry meadows.

"Wet meadow or marsh is characterized principally by sedges and remains wet or moist throughout the summer. These shall be designated as 2W.

"Dry meadow or flood plain is dominated by grasses rather than sedges and occur as moist meadowlike area or intermittent meadow, both of which become moderately dry by midsummer. These shall be designated as 2D.

"3 - Perennial forbs. Includes all entimbered areas where perennial forbs predominate over other classes of vegetation. There is very little true forb type, as a forb cover is usually more or less temporary in character and is soon replaced by a more permanent type if the disturbing factor is removed. If there is no great predominance of the forbs over the grass or shrub vegetation, and if it is possible to judge that the forb predominance is due to some unnatural factor, the forbs should be disregarded in designating the type and the more stable vegetation should be used as an index. The forbs will then be cared for in the subtype.

"4 - Sagebrush. This type includes all untimbered lands where sagebrush or shrubby species of similar character predominate. The sagebrush lands are usually of different range values and different in season of grazing from the areas which are listed below under mountain shrub. Areas dominated by shrubby species of sagebrush, including big sagebrush (*Artemisia tridentata*) shall be classed as subtypes, as for example: _Artemisia filifolia_, _A. cana_, and _A. tripartita_. Other shrubby species such as _Chrysothamnus_ should be designated as subtypes when they become dominate in sagebrush areas.

"This and the mountain shrub type which follows are sometimes difficult to distinguish from the grass and forb types when aspect rather than the dominant class of forage is used as the distinguishing characteristic. Sagebrush may form only 15 percent of the total vegetation of a type and still its aspect may be that of a sagebrush type.

"It may prove desirable, in a given region, to decide on a certain percentage of all the vegetation in the type, say 20 percent, as the minimum proportion of sagebrush that may be present if the area is still to be classified as a 4 type, providing, of course, it does not already have the aspect of some other type. The same will hold true of the mountain shrub.

"5 - _Mountain shrub_. This type includes all untimbered lands where mountain shrubs, excepting sagebrush or its subtypes, gives the main aspect ot the type or is the predominate vegetation. Characteristically it occupies the transition zone of the lower mountain slopes, foothill, and plateau areas. Examples of subtypes are mountain mahogany, bitter brush, willows, Ceanothus, manzanita, California chaparral, etc.

"6 - _Conifer_. This type includes all range in coniferous timber supporting grasses, forbs, or shrubs, either singly or in combination, except as provided under types 7 and 9. The forage may vary from a pure stand of pinegrass, or some other grass, to a pure stand of forbs or shrubs. It usually, however, consists of grasses, forbs, and shrubs, and the proportion of each species varies so widely that it is not thought advisable to attempt a division into types with distinct colors. These variations can best be represented by subtypes.

"7 - _Waste_. This type includes all areas of dense timber and brush which have no value for grazing domestic livestock or have such slight value that they cannot be used economically, owing either to denseness of standing or down timber or sparseness of forage growth. Large areas of very sparse forage, unless within easy reach of a better type, shall be classified as waste because of the impracticability of running stock over so large an area to get such a small amount of feed.

"This type also includes other waste areas not strictly in timber or brush and not barren, but so rough or inaccessible as to make their future use improbable.

"The subtype designations generally encountered in this type are as follows: 7T-waste in dense timber; 7D-waste in down timber; 7B-waste in brush; 7R-waste areas where rocky character prevents use; and 7I-permanently inaccessible areas. Principal species of timber should be shown by symbols.

"For any 7 type which is or can be used by game animals, the type number is modified by adding after the "7" designation the number (in parentheses) of the aspect vegetative type involved. This combination type number will indicate value for game forage and habitat.

"8 - Barren. This type includes all areas on which there is no natural vegetation, or practically none, including intermittent lake beds, saline flats, active sand dunes, shale, rock slides, lava flows, etc. Areas which have been denuded by overgrazing or other causes should not be confused with areas naturally barren, nor should areas containing only annuals for a part of the year be shown as "barren" although these may be without vegetation for the remainder of the year.

"9 - Pinon-juniper. This type includes pinon, juniper, pinon-juniper, and digger pine. The character of the range in this type as regards location, grazing capacity, and management is sufficiently distinct from the conifer type to justify a separate color. The forage may vary from a pure stand of grasses, forbs, or shrubs to a combination of any two or all. This variation can best be shown by subtype designations.

"10 - Broad leaf trees. This type includes all range in deciduous timber. The combination of grasses, forbs, and shrubs, and the proportion of individual species, will vary as in other types.

"The principal subtypes which will be encountered are: aspen, cottonwood, oak, birch, alder, ash-elm, etc., when they occur in tree form.

"13 - Saltbush. This type includes areas where the various salt desert shrubs of the *Atriplex* genus form the predominant vegetation, or give the characteristic aspect. There is sufficient significant difference in the range value and the use of saltbush areas to justify their separation from other desert or semi-desert shrub types.

"14 - Greasewood. This type includes areas where greasewood (*Sarcobatus*) is the predominant vegetation or gives a characteristic aspect. Usually this type occupies valley floors subject to overflow during flood periods or areas underlain with ground-water at shallow depths where the soil is more or less saline. It is sufficiently differentiated from other desert shrubs to justify an exclusive type.

"15 - Winterfat. This type includes areas where winterfat (*Eurotia*) gives a characteristic aspect or constitutes the predominant vegetation. Though commonly associated with other semi-desert shrubs, the occurence of this plant in Utah and Nevada as a type character is of sufficient extent to justify a separate type.

"16 - Desert shrub. This is a general type which includes areas where other desert shrubs aside from those separated into individual types, constitute the predominant vegetation or give the characteristic aspect. This type includes several genera which are quite distinctive in type habit such as black brush (*Coleogyne*), coffee berry (*Simmondsia*), catchlaw (*Acacia or Mimosa*), gray molly (*Kochia*), hopsage (*Grayia spinosa*), and spiny horsebrush (*Tetradymia spinescens*), but pure types of each are too limited in extent to justify separate types. The plant symbols used will be sufficient to indicate the predominant species present.

"17 - Half shrub. This type includes areas where half shrubs constitute the dominant vegetation or give the characteristic aspect.

"Half shrubs are semi-woody perennials of low stature such as *Aplopappus*, *Gutierrezia*, *Artemisia frigida*, *Eriogonun wrightii*, etc. They commonly consist of a woody caudex from which herbaceous stems are produced that die back annually. These genera are sufficiently distinctive in habitat and of wide enough extent in certain localities to justify a separate type designation.

"18 - Annuals. This type includes areas in which annual forbs or annual grasses constitute the dominant vegetation. Both transitory stages and semipermanent conditions should be included in this type as for example: russian thistle, downy chess (*Bromus tectorum*), and desert forbs. The plant symbols used will be sufficient to indicate the predominant species present.

METHOD OF RANGELAND INVENTORY

The ecological method of range inventory was used on the Tongue River Area. This system states what is the potential production of the rangeland, in terms of quantity and kinds of forage, and then relates the present range production to that potential.

Range was defined as lands on which the original plant community is one of native grasses, forbs and shrubs. This includes lands with low grazing value, such as desert, badlands and other naturally barren and semi-barren lands - but excludes forested areas.

Range classification by the ecological method rests on two essential concepts. The first concept is that of dividing the range area into "range sites". The second concept is that of the "climax" plant community that develops under the regional climate but is strongly influenced by the unique environment of each range site.

Range Sites

Range sites can be located and mapped because each may be described in terms of soil depth, soil texture, topography, parent materials, alkalinity or acidity, stoniness, slope, exposure and organic matter.

Range sites are held to a minimum number. A new range site is proposed only if a need develops for a different evaluation. The site must have either, (1) differences in species of the climax plant community, or (2) differences in the range sites total plant production, or both. But these differences must be great enough to require some variation in management.

Plant Communities

The sum of influences peculiar to each range site leads to the development of its characteristic and unique plant community.

When the range site and its plant community is modified in some way, such as an increase of soil fertility or a decrease in light intensity, the environment may favor some plants more than others. One plant species may replace another, or one plant community replace another, and this second community may be replaced by a third, in a series of stages moving towards the climax community. The final stage, the climax, persists as long as there is no change in climate.

Within a particular climatic region changes on all plant communities tend towards one uniform climax plant community. For example, the tall-grass prairie (big bluestem, switchgrass, indiangrass) occurs on limestone, granite, clays and shales, floodplain deposits, sands and calcareous marls. Exceptions to this one-climax plant community are usual and this is the basis for a range site.

Within a particular climatic region with its characteristic climax plant community the range site itself limits the vigor of individual plants, their productivity, and the community composition. For example, soils developed from marine shales may be saline or alkaline and have plant communities that differ markedly in composition and vigor from adjacent plant communities that occur on salt-free soil. A plant climax on the optimal soils characteristic for a climatic region is called the climatic climax; the community that develops on soils which strongly influence the climatic change is called an edaphoclimatic climax, (Greek - edaphos, soil),because the influence of soil and climate are nearly equal. This is the concept of the range site and its **climax** community.

Application

A guide for field crew use is prepared. A range site field guide covers large physiographic areas such as the Montana Glaciated Plains (about one-third of the State). The guide has descriptions of both the range site and its unique climax plant community. In preparing the guide, description of the range site is usually easy; description of the climax plant community is more difficult.

The climax plant community for a range site is found in part by searches for protected or relatively undisturbed rangeland. Disturbance is normal to most sites, which may be used by wildlife even if not by livestock. The plant community of the least disturbed range sites represents the potential vegetation reasonably well. (This is not always true as undisturbed sites will show unexpected departures from a concept of luxuriant grass or forb cover. One relict in the saline soils of the Red Desert of Wyoming was nearly 100% horsebrush, a poisonous plant. This example is rare but such evidence must be considered in evaluating other relicts.)

Grazing district records, experiment station ranges are also investigated. A search is made of scientific literature and of historical accounts. The evidence from any one source cannot be conclusive - all are considered.

The guides, in their limits of plant occurrence, necessarily include a broad range of abundance possible for the species of the climax community - because the range site itself varies.

Extensive range sites with similar soils and topography may differ in forage production, therefore, very large range sites often must be divided into precipitation zones.

Range sites are permanent, their climax plant communities, if disturbed, will re-establish, although the plant cover may be changed temporarily by drouth, grazing, fire, or farming. Sometimes one factor is so drastic in its action the range site is changed permanently.

The impact of farming, for example, may be so prolonged as to change the original range site by excessive soil loss through erosion. A new range site with its altered potential is then described. (Range sites are named, if possible, from the physical character of the site, i.e., Badlands or Saline Uplands, etc.)

Range Condition

In practice range condition is found by listing the relative quantities of plants. This is compared with the climax plant community of that range site. Differences,if any, are described in four classes as "Excellent", "Good", "Fair", or "Poor". (Note: These are poorly chosen words that lead often to misinterpretation of the intent of ecological inventories. But they are used in range management literature so extensively these classes are retained in Missouri River Basin use.)

These classes show the degree to which the present plant community, estimated to the nearest five percent for each plant, departs from that of the climax plant community. 1/

This vegetative benchmark is necessary and departures are stated by percentages because the range forage is harvested by animals. Grazing and browsing animals are selective and will use their preferred feed.

(A range site with its unique climax plant community if it were grazed by sheep would lose forbs and browse plants to become more of a grassland. Cattle use would result in much less grass and more forbs and brush. Goats or deer would remove more of the shrubby species. All of these departures from the climax are most simply expressed quantitatively by percentage rather than by unwieldly descriptions.)

1/ The estimates for present and climax plant community is volume production, the relative quantities produced by each species. This includes all photosynthetic surfaces. Prickly pear,for instance, will have succulent pads many years old, which compete for light and water. Brush, on the other hand, is considered only as to the leaves and the current annual growth of twigs.

Community Reactions in Determining Range Condition

First, plants of the climax community are grouped as decreasers, increasers, or invader plants. These groups represent the plant's reaction to heavy grazing pressure.

Under continued heavy grazing:

1. Decreaser plants slowly disappear relative to the other plants in the community.

2. Increasers replace the decreasers. Increasers have a limit in the climax; not until the decreasers dwindle away can the increasers spread out into the newly available space. Under heavy grazing low-value increaser plants will usually seize territory faster than high-value plants.

This limit on increaser plants is a key in calculation. Our base point is the most stable plant community - the climax. Plants limited in the climax community therefore indicate a change to unstable conditions when they exceed that limit. The plant guide lists each increaser plant species with its limit for each range site, amounts in excess are disregarded.

Ignoring the presence of invader plants, the steps are now:

1. Total the percentages of all decreaser plants. (Decreaser plant species are in the guide for each range site.)

2. Increasers are totalled in their present quantity also, but only to that limit of each species in the climax community. Any excess is ignored. (The increaser plant species and its limit is in the guide for each range site.)

3. These two amounts are totalled - decreasers as found plus allowable quantities of increasers.

The score, the total of decreasers and allowable quantities of increasers is: 0-25 percent - Poor, 25-50 percent - Fair, 50-75 percent - Good, and over 75 percent is rated Excellent.

One group of plants, invaders, have been ignored. Invaders move into the plant communities as the increasers begin to disappear under continuous heavy use. They are not a part of the climax plant community of the range site so cannot enter into the calculation of any departure from climax.

Invaders include all annuals. Woody plants, and herbaceous perennials are list in the range site guide for the sites on which they are considered invaders. (Invaders are present in the climax as, for example, sunflowers on the raw soil at the entry to a rodent burrow, but the five percent increments in estimating forage would eliminate their consideration.)

Results

Management is not predicated on high scores in range condition. It is based on the appropriate kinds of plants on the range. Spring range with annual grasses might be far from the original plant community for the site, yet meet the exact need for economic management. The ecological system of range inventory uses the original plant community as the benchmark to which the ever-changing rangelands can be referenced. Goals can be envisioned and results forecast by use of the concepts of range site and its climax vegetation.

APPENDIX C Section 3

Guide to Plant Names as used in U. S. Geological Survey 1924 Land Classification

U. S. G. S. Land Classification 1924		Standardized Plant Names
Common Name	Scientific Name 1/	Common Name
GRASSES AND GRASSLIKE PLANTS:		
Blow out grass	Redfieldia flexuosa	Blowoutgrass
Blue grass	Poa pratensis	Kentucky bluegrass
Big blue stem	Andropogon gerardi	Big bluestem
Little blue stem	Andropogon scoparius	Little bluestem
Brome grass	Bromus spp.	Brome
Buffalo grass	Buchloe dactyloides	Buffalograss
Fescue	Festuca spp.	Fescue
Foxtail	Hordeum jubatum	Foxtail barley
Giant wild rye	Elymus cinereus	Giant wildrye
Blue grama	Bouteloua gracilis	Blue grama
Side oats grama	Bouteloua curtipendula	Sideoats grama
Long awn needlegrass	Stipa comata	Needleandthread
Short awn needlegrass	Stipa viridula	Green needlegrass
Pine grass	Calamagrostis rubescens	Pinegrass
Prairie june grass	Koeleria cristata	Junegrass
Redtop	Agrostis alba	Redtop
Rushes	Juncus spp.	Rush
Sand dropseed	Sporobolus cryptandrus	Sand dropseed
Sand grass	Calamovilfa longifolia	Prairie sandreed
Salt grass	Distichlis stricta	Inland saltgrass
Nigger wool	Carex filifolia	Threadleaf sedge
Prairie sedge	Carex stenophylla	Needleleaf sedge
Wire grass, triple awn, or poverty grass	Aristida longiseta	Red threeawn
Slender wheat grass	Agropyron pauciflorum	Slender wheatgrass
Wheat bunch grass	Agropyron spicatum	Bearded bluebunch wheatgrass
Western wheatgrass	Agropyron smithi	Bluestem wheatgrass
SHRUBS:		
Buckthorn	Rhamnus spp.	Buckthorn
Buck brush	Symphoricarpos spp.	Snowberry
Buffalo berry	Shepherdia argentea	Silver buffaloberry

1/ Scientific names are in accord with current taxonomic nomenclature

Section 3 Guide to Plant Names (U. S. G. S.)
(App. C Cont.)

U. S. G. S. Land Classification 1924		Standardized Plant Names
Common Name	Scientific Name 1/	Common Name
SHRUBS:		
Chaparral	Ceanothus spp.	Ceanothus
Chokecherry	Prunus melanocarpa	Black chokecherry
Cinquefoil	Pontentilla fruticosa	Bush cinquefoil
Creeping juniper	Juniperus spp.	Juniperus
Currant	Ribes spp.	Currant
Gooseberry	Grossularia spp.	Gooseberry
Greasewood	Sarcobatus vermiculatus	Black greasewood
Kinnikinnick or Bearberry	Arctostaphylos uva-ursi	Bearberry kinnikinnick
Matchweed	Gutierrezia sarothrae	Broom snakeweed
Mountain mahogany	Cercocarpus	True mountain mahogany
Oak brush	Quercus spp.	Oak
Prickly pear	Opuntia spp.	Prickly pear
Rabbitbrush	Chrysothamnus spp.	Rabbitbrush
Black sagebrush	Artemisia tridentata	Big sagebrush
Bud sagebrush	Artemisia spinescens	Bud sagebrush
Green sagebrush	Artemisia dracunculoides	Falsetarragon sagebrush
Mountain sagebrush	Artemisia frigida	Fringed sagebrush
Sand sagebrush	Artemisia filifolia	Sand sagebrush
Valley sagebrush	Artemisia cana and Artemisia gnaphalodes	Silver sagebrush Cudweed sagebrush
Shadscale	Atriplex confertifolia	Shadscale saltbush
Salt sage	Atriplex gardneri	Gardner saltbush
Soapweed	Yucca glauca	Small soapweed
Squawberry	Shepherdia canadensis	Russet buffaloberry
Serviceberry	Amelanchier alnifolia	Saskatoon serviceberry
Wild red plum	Prunus americana	American plum
Wild rose	Rosa spp.	Rose
Willows	Salix spp.	Willows
Winter fat	Eurotia lanata	Common winterfat
WEEDS:		
Astragalus	Astragalus spp.	Loco; milkvetch; poisonvetch
Balsam root	Balsamorhiza sagittata	Arrowleaf balsamroot
Butterweed	Senecio spp.	Groundsel
Daisy	Erigeron spp.	Fleabane
Gumweed	Grindelia squarrosa	Curlycup gumweed
Loco weed	Oxytropis spp.	Crazy weed

1/ Scientific names are in accord with current taxonomic nomenclature

U. S. G. S. Land Classification 1924		Standardized Plant Names
Common Name	Scientific Name 1/	Common Name
Lupine	Lupinus spp.	Lupine
Phlox	Phlox hoodi	Hoods phlox
Psoralea or wild alfalfa	Psorelea tenuiflora and Psorelea argophylla	Slimflower scurfpea Silverleaf scurfpea
Purple cone flower	Echinacea angustifolia	Blacksamson echinacea
Russian thistle	Salsola kali	Russianthistle
Stickweed	Lappula occidentalis	Stickseed
Sunflowers	Helianthus and Helianthella spp.	Sunflower
Thistle	Carduus spp.	Bristlethistle
Vetch	Vicia spp.	Vetch
Wild buckwheat	Eriogonum spp.	Eriogonum
Wild flax	Linum lewisi	Lewis flax
Yarrow	Achillea millefolium	Common yarrow
TREES:		
Ash	Fraxinus spp.	Ash
Aspen	Populus tremuloides	Quaking aspen
Balsam or alpine fir	Abies lasiocarpa	Alpine fir
Box elder	Acer negundo	Box elder
Cottonwood	Populus spp.	Cottonwood
Cedar or juniper	Juniperus spp.	Juniper
Douglasfir	Pseudotsuga menziesi	Common Douglasfir
Elm	Ulmus americana	American elm
Engelmann spruce	Picea engelmanni	Engelmann spruce
Limber pine	Pinus flexilis	Limber pine
Lodgepole pine	Pinus contorta latifolia	Lodgepole pine
Western yellow pine	Pinus ponderosa	Ponderosa pine

1/ Scientific names are in accord with current taxonomic nomenclature

APPENDIX C Section 4

Definitions of Land Classes Used by U.S. Geological Survey Land Classification (1924)

Irrigated and Irrigable Land:

Deep soils, actually irrigated or potentially irrigable land already under a ditch.

Dry-Farming Land:

Dry-farming land had a smooth surface. Climatic conditions, soil texture, and fertility were favorable to successful production of hardy grain crops in most years. Soil textures ranged from sandy-loam to clay-loam; the minimum precipitation was from 14 to 20 inches; 50 percent or more of the total precipitation occured from May to September, with a growing season of 100 to 120 days.

Farming-Grazing Land:

Farming-grazing land had a smooth to gently rolling surface. Climate, soil texture, and fertility were favorable to the successful production of grain crops 75 percent of the time, but yields were minimum; precipitation was from 12.5 to 17 inches; 50 percent or more of the total precipitation occurred during the 6 month period from April to September. This was land on which a farmer could earn a livelihood every year and make a moderate profit for at least two-thirds of the years.

Grazing-Forage Land:

Grazing-forage land had a smooth to gently rooling surface. Climate, soil texture, and fertility were such that grain crops could be successfully produced only occasionally. Soils in this classification had a friable texture but were clay or coarse-sandy to gravelly type, either incapable of readily absorbing or retaining moisture. Normal rainfall ranged from 10.5 to 13 inches. Wheat or rye, cut green for hay, was considered the only sure crop in this land. Most of the area thus classified would always be used for livestock grazing.

Grazing Land:

Grazing land was divided into two classes: tillable and non-tillable. Tillable grazing land was relatively smooth and physically tillable, which, because of low rainfall or heavy or shallow soil, was unfit for profitable production of crops. Non-tillable grazing land included all remaining lands that could be used only for grazing or timber production, rough broken mountain slopes and plains dissected by erosion into rough breaks and badlands, as well as gravel terraces.

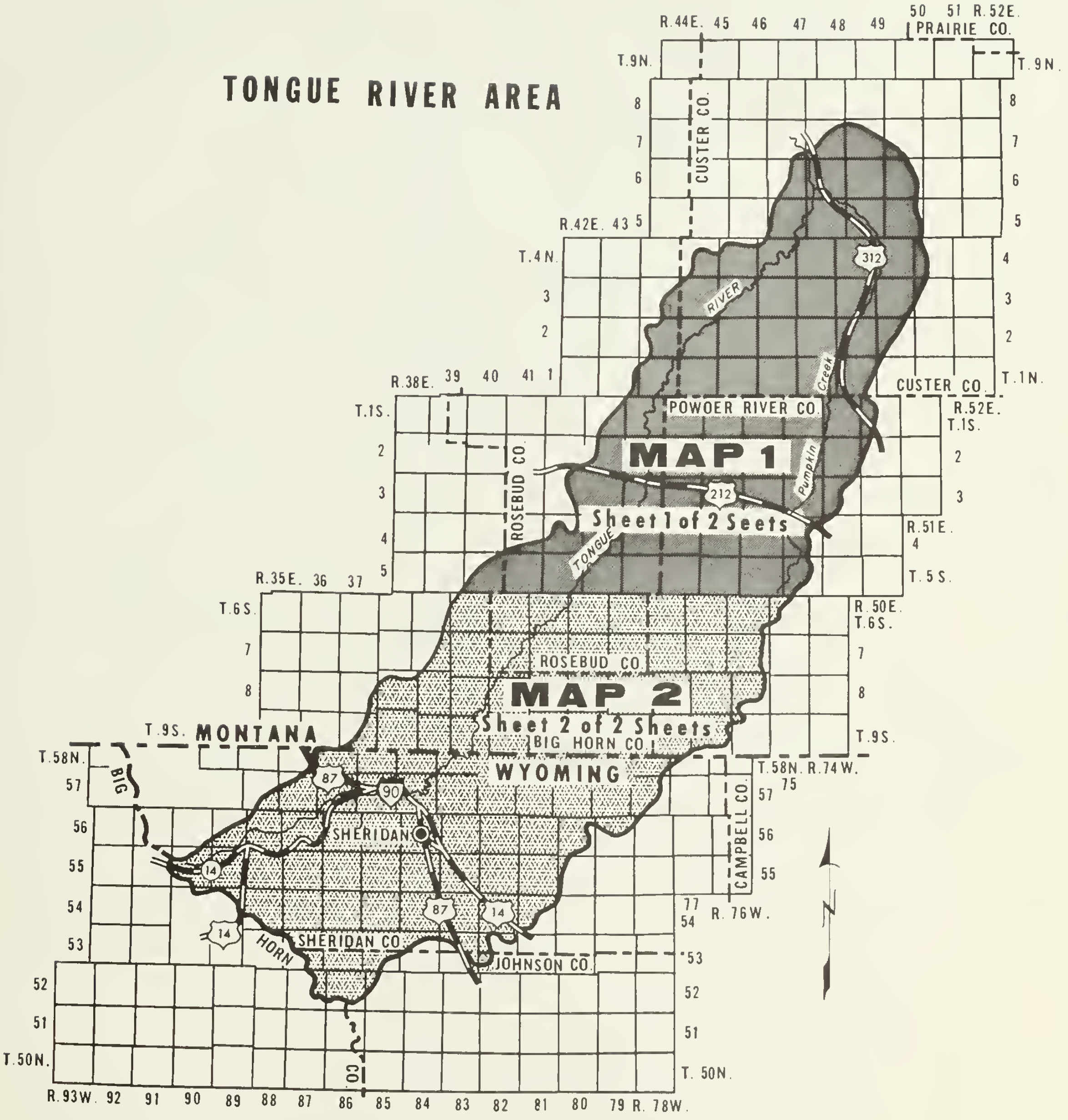
Missouri River Bottom-land:

These were river-bottom lands between nearly parallel lines of bluffs; the alluvial plains formed by the stream flowing through them. Soil textures varied from very fine loam to sand. The subsurface was usually saturated with ground water. Most of such land, especially the better types, were irrigated.

Stony Land:

Stony lands were areas of level to gently rolling land with a surface mantle of glacial debris of large stones or boulders from three to five inches or larger, and used only for grazing.

TONGUE RIVER AREA



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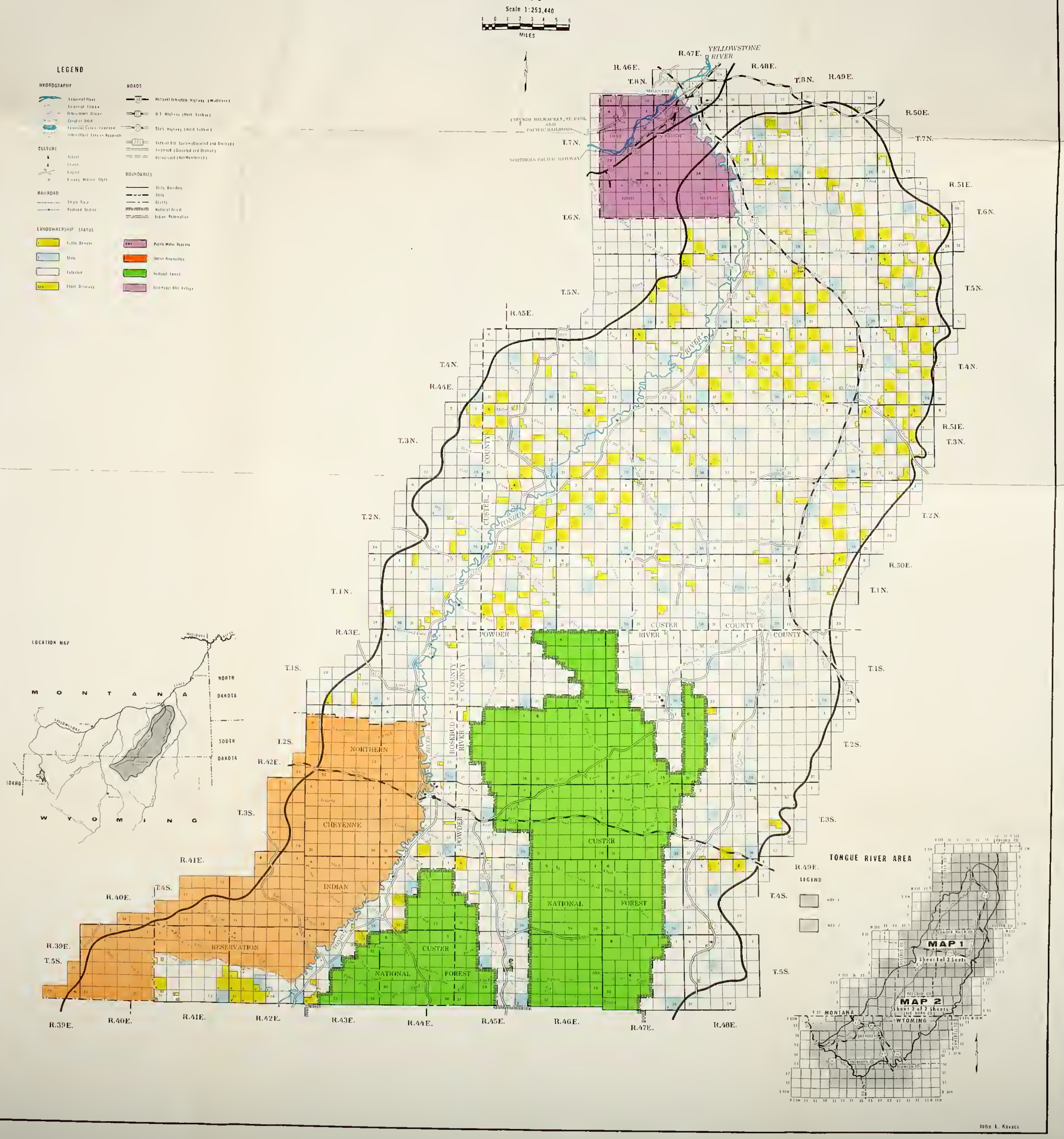
MAP 1
TONGUE RIVER AREA

SHEET 1 OF 2 SHEETS

MONTANA

MISSOURI RIVER BASIN STUDIES
DENVER SERVICE CENTER
DENVER, COLORADO
1966



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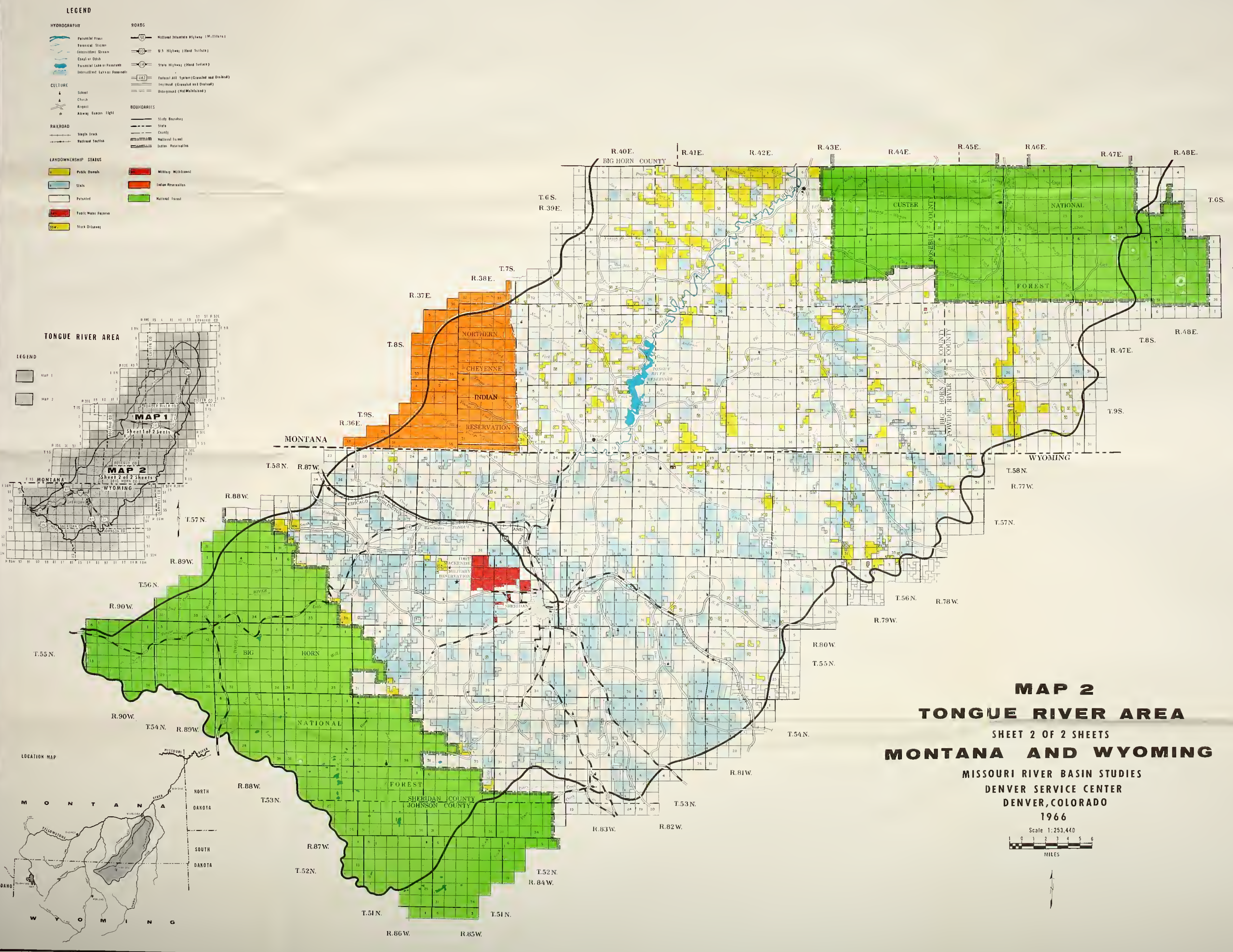

MAP 2

TONGUE RIVER AREA

SHEET 2 OF 2 SHEETS

MONTANA AND WYOMING

MISSOURI RIVER BASIN STUDIES
DENVER SERVICE CENTER
DENVER, COLORADO
1966

Scale 1:253,440

MILES

John L. Kovacs

MAP 2

E RIVER AREA